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INSTALLATION RESTORATION PROGRAM
PHASE I: RECORDS SEARCH
WILLIAMS AFB, ARIZONA

Prepared For

United States Air Force
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A-1

TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

TABLE OF CONTENTS
(Continued)

LIST OF FIGURES

TABLE OF CONTENTS

(Continued)

LIST OF FIGURES (Continued)

LIST OF TABLES

TABLE OF CONTENTS
(Continued)

LIST OF TABLES (Continued)

EXECUTIVE SUMMARY

The Department of Defense (DOD) has developed a program to identify and evaluate past hazardous material disposal sites on DOD property, to control the migration of hazardous contaminants, and to control hazards to health or welfare that may result from these past disposal operations. This program is called the Installation Restoration Program (IRP). The IRP has four phases consisting of Phase I, Initial Assessment/Records Search; Phase II, Confirmation and Quantification; Phase III, Technology Base Development; and Phase IV, Operations /Remedial Actions. Engineering-Science (ES) was retained by the United States Air Force to conduct the Phase I, Initial Assessment/Records Search for Williams Air Force Base (AFB) under Contract No. F08637 80 G0009 5013.

INSTALLATION DESCRIPTION

Williams Air Force Base is located approximately 30 miles southeast of Phoenix, Arizona in Maricopa County. The main base has an area of 4,127 acres. Three off-base annexes include Rittenhouse Auxiliary Field (604 acres) 7 miles southeast, Coolidge-Florence Municipal Airport (5 acres) 7 miles southeast, and Williams Recreation Area ("Waterdog" - 26 acres) 30 miles northeast.

Williams Air Force Base was constructed in 1941 and has served as a training facility throughout its history. Pilot training has been the primary activity. A wide variety and significant numbers of aircraft have been based at Williams in support of its training mission.

ENVIRONMENTAL SETTING

The environmental setting data reviewed for this investigation identified the following points that are relevant to Williams AFB:

- The soils on the base are moderately permeable which allows for good infiltration of water to the subsurface. However, net precipitation, which is rainfall minus evaporation, is -65 inches indicating that there is little potential for leachate generation at hazardous waste sites resulting from infiltrating rainfall.
- Rainfall intensity and land slope at the base indicates there is some potential for erosion and transport of surface contaminants from hazardous waste sites. The one-year, 24-hour rainfall is used to help judge erosion potential. This rainfall event at the base is 1.5 inches which is considered low to moderate in intensity. The land slope is 0.4 percent which is moderate.
- The unconsolidated alluvial deposits at and around the base are the source for ground water in the area of the base. This aquifer system consists of a deep water table aquifer that underlies the area and a shallower perched water table aquifer that underlies a part of the area including the western one-half of the base. At Williams AFB the depth to the deep water table is approximately 400 feet. The depth to the perched water table is about 200 feet.
- Flooding potential at the base is minimal. The base lies between the 100-year and 500-year flood plain for streams in the Gila River Basin.
- Numerous wells are located on and around the base. There are four deep wells on the base. These wells are used for public supply. Wells around the base are generally used for public supply or irrigation.
- Treated water from the wastewater treatment plant on the base is used to irrigate the base golf course or is discharged to the Roosevelt Canal. The effluent from the plant meets federal and state requirements.
- The water quality of the ground water from wells on the base meets the primary drinking water standards for those parameters measured.

- No threatened or endangered plant or animal species are known to exist on the base.

METHODOLOGY

During the course of this project, interviews were conducted with base personnel (past and present) familiar with past waste disposal practices; file searches were performed for past hazardous waste activities; interviews were held with state and federal agencies; and field surveys were conducted at suspected past hazardous waste activity sites. Nine sites (Figure 1) were initially identified as potentially containing hazardous contaminants and having the potential for contaminant migration resulting from past activities. These sites have been assessed using a Hazard Assessment Rating Methodology (HARM) which takes into account factors such as site characteristics, waste characteristics, potential for contaminant migration and waste management practices. The details of the rating procedure are presented in Appendix G and the results of the assessment are given in Table 1. The rating system is designed to indicate the relative need for follow-on investigation.

FINDINGS AND CONCLUSIONS

The following conclusions have been developed based on the results of the project team's field inspection, reviews of base records and files, interviews with base personnel, and evaluations using the HARM system.

The areas found to have sufficient potential to create environmental contamination are as follows:

- Fire Protection Training Area No. 2
- Liquid Fuels Storage Area
- Surface Drainage System - Southwest
- Landfill
- Pesticide Burial Site
- Surface Drainage System - Northwest

FIGURE 1

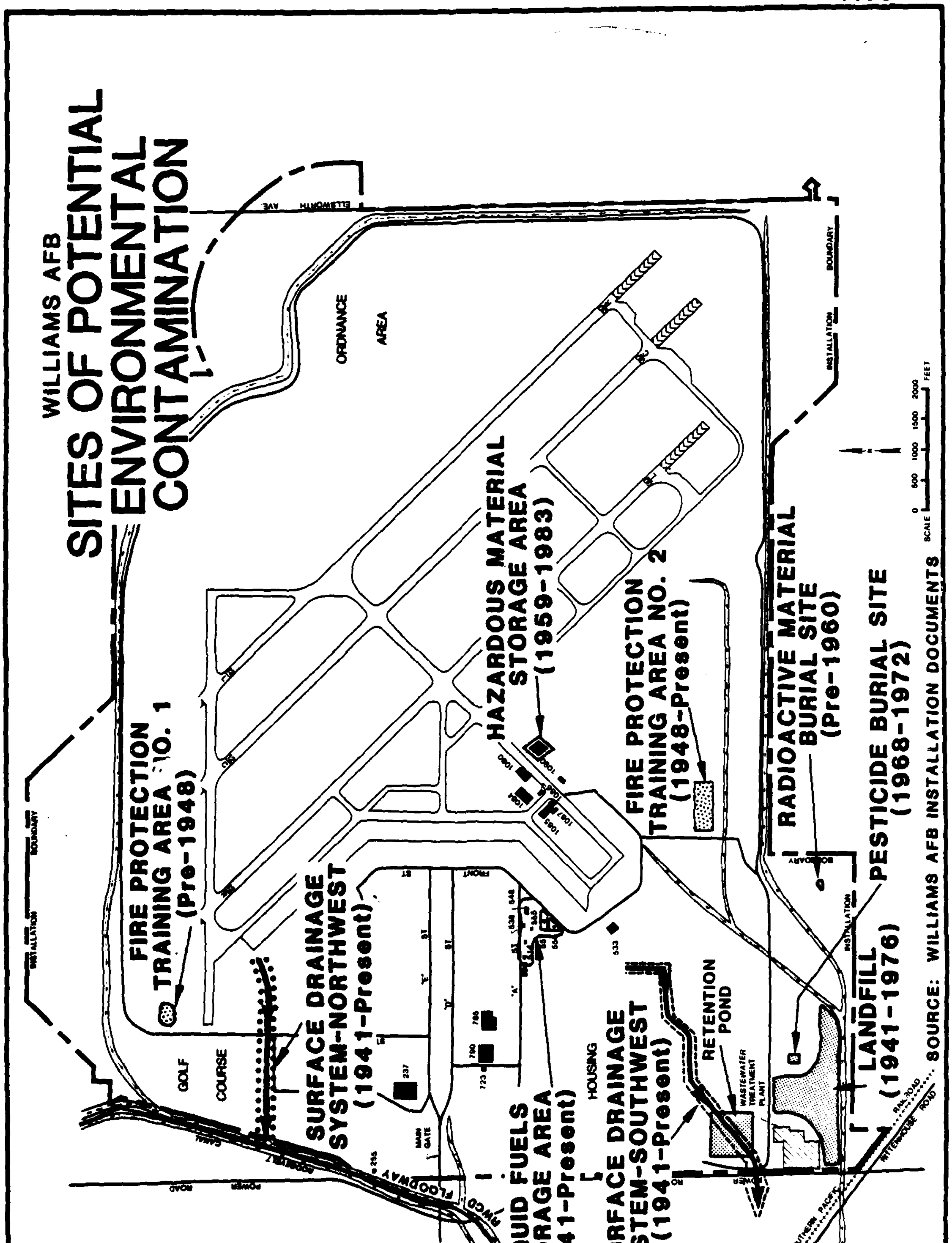

WILLIAMS AFB
SITES OF POTENTIAL ENVIRONMENTAL CONTAMINATION
FIRE PROTECTION TRAINING AREA NO. 1 (Pre-1948)
SURFACE DRAINAGE SYSTEM-NORTHWEST (1941-Present)
LIQUID FUELS STORAGE AREA (1941-Present)
SURFACE DRAINAGE SYSTEM-SOUTHWEST (1941-Present)
RETENTION POND
WASTEWATER TREATMENT PLANT
HAZARDOUS MATERIAL STORAGE AREA (1959-1983)
FIRE PROTECTION TRAINING AREA NO. 2 (1948-Present)
RADIOACTIVE MATERIAL BURIAL SITE (Pre-1960)
PESTICIDE BURIAL SITE (1968-1972)
LANDFILL (1941-1976)
GOLF COURSE
HOUSING
MAIN GATE
ORDNANCE AREA
ELLSWORTH AVE
POWER ROAD
RWCD FLOODWAY
INSTALLATION BOUNDARY
SOUTHERN PACIFIC RAILROAD
RITTENHOUSE ROAD
SCALE 0 500 1000 1500 2000 FEET
SOURCE: WILLIAMS AFB INSTALLATION DOCUMENTS

TABLE 1
SITES EVALUATED USING THE HAZARD
ASSESSMENT RATING METHODOLOGY
WILLIAMS AFB

Rank	Site	Operation Period	Final Score[1]
1	Fire Protection Training Area No. 2	1948 - Present	61
2	Liquid Fuels Storage Area	1941 - Present	59
3	Surface Drainage System - Southwest	1941 - Present	58
4	Landfill	1941 - 1976	55
5	Pesticide Burial Site	1968 - 1972	55
6	Surface Drainage System - Northwest	1941 - Present	54
7	Hazardous Material Storage Area	1959 - 1983	43
8	Fire Protection Training Area No. 1	1941 - 1948	40
9	Radioactive Material Burial Site	Pre - 1960	39

(1) This ranking was performed according to the Hazard Assessment Rating Methodology (HARM) described in Appendix G. Individual rating forms are in Appendix H.

The areas judged to have minimal potential to create environmental contamination are as follows:

- o Hazardous Material Storage Area
- o Radioactive Material Burial Site
- o Fire Protection Training Area No. 1

RECOMMENDATIONS

Recommended guidelines for future land use restrictions at the disposal sites are presented in Section 6. A program for proceeding with Phase II of the IRP at Williams AFB is also presented in Section 6. The recommended actions include a one-time soil boring, sampling and analysis program to determine if contamination exists. This would be expanded to define the extent and type of contamination if the initial step reveals site contamination. The Phase II recommendations are summarized in Table 2.

TABLE 2
RECOMMENDED MONITORING PROGRAM FOR PHASE II
IRP AT WILLIAMS AFB

Site (Rating Score)	Recommended Monitoring Program*
Fire Protection Training Area No. 2 (61)	Obtain 3 soil borings around each old fire pit,, 2 borings located around the site between the pits, and 4 borings (including control) in the vicinity of the old drum storage area and site runoff area. Take 10-foot deep borings. Collect samples at the following depths and at any major soil interface: 0.5, 1.5, 3.5, 5.5, 7.5 and 10.0 feet. Fill and compact sample holes with clay. Analyze water extractions performed on the soil samples for the parameters in List A, Table 6.2. Perform analyses on the shallow samples first to determine the need for testing the deeper ones.
Liquid Fuels Storage Area (59)	Obtain 2 soil borings in each of the spill and leak areas identified at Facilities 538, 548 and 555 (see Figure 4.4) plus 1 control boring. In the leak area (548) take 20-foot deep borings and in the spill areas (538 and 555) obtain 10-foot borings. Collect samples at the following depths and any major soil interface for the spill area borings: 0.5, 1.5, 3.5, 5.5, 7.5 and 10.0 feet. For the leak area take samples at 3-foot intervals. Fill and compact sample holes with clay. Analyze water extractions for the parameters in List A, Table 6.2. Perform analyses on the shallow samples first for the spill area borings to determine the need for testing the deeper ones. Use field observations for determining analysis priorities on the leak area samples.
Surface Drainage System - Southwest (58)	Using a hand auger obtain soil samples at 4 locations in the open drainage channel and 1 in the retention pond plus 1 control. Collect a surface sediment sample and another sample 4.0 feet deep. Fill and compact sample holes with clay. Analyze water extractions on the soil samples for the parameters in List B, Table 6.2.

TABLE 2
RECOMMENDED MONITORING PROGRAM FOR PHASE II
IRP AT WILLIAMS AFB

(Continued)

Landfill (55)	Conduct geophysical survey using electromagnetic conductivity techniques to define the boundary of the filled area. Using these data locate and obtain 6 slanted soil borings spaced at regular intervals around the perimeter of the site. These borings will be angled to avoid penetrating the filled area but designed to obtain soils information beside and under the fill. Total boring length will vary by location, probably 50-100 feet. Slant borings on the southern perimeter may be shorter than those on other sides when tanken in the adjacent drainage channel. One vertical control boring will also be required. Collect samples at 2 to 4 foot intervals beside/under the landfill and analyze the water extracts for the parameters in List C, Table 6.2. Fill and compact sample holes with clay.
Pesticide Burial Site (55)	Conduct geophysical survey using either electromagnetic conductivity or magnetometer techniques to define the specific area where drums and/or containers are buried. No sampling or analytical work is recommended in Phase II; instead it will be more cost-effective and environmentally expedient to excavate and remove the buried containers as discussed in "Other Recommendations" in Section 6.
Surface Drainage System - Northwest (54)	Using a hand auger obtain soil samples at 3 locations in the open drainage channel and 1 control. Collect a surface sediment sample and another sample 4.0 feet deep. Fill and compact sample holes with clay. Analyze water extractions on the soil samples for the parameters in List D, Table 6.2.

* If contamination is identified, this soil sampling program may need to be expanded to define the extent and type of contamination.

Source: Engineering-Science, Inc.

SECTION 1

INTRODUCTION

BACKGROUND AND AUTHORITY

The United States Air Force, due to its primary mission of defense of the United States, has long been engaged in a wide variety of operations dealing with toxic and hazardous materials. Federal, state, and local governments have developed strict regulations to require that disposers identify the locations and contents of past disposal sites and take action to eliminate hazards in an environmentally responsible manner. The primary Federal legislation governing disposal of hazardous waste is the Resource Conservation and Recovery Act (RCRA) of 1976, as amended. Under Section 6003 of the Act, Federal agencies are directed to assist the Environmental Protection Agency (EPA) and under Section 3012, state agencies are required to inventory past disposal sites and make the information available to the requesting agencies. To assure compliance with these hazardous waste regulations, the Department of Defense (DOD) developed the Installation Restoration Program (IRP). The current DOD IRP policy is contained in Defense Environmental Quality Program Policy Memorandum (DEQPPM) 81-5, dated 11 December 1981 and implemented by Air Force message dated 21 January 1982. DEQPPM 81-5 reissued and amplified all previous directives and memoranda on the Installation Restoration Program. DOD policy is to identify and fully evaluate suspected problems associated with past hazardous contamination, and to control hazards to health and welfare that resulted from these past operations. The IRP is the basis for response actions on Air Force installations under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, clarified by Executive Order 12316. CERCLA is the primary legislation governing remedial action at past hazardous waste disposal sites.

PURPOSE AND SCOPE OF THE ASSESSMENT

The Installation Restoration Program has been developed as a four-phased program as follows:

Phase I	-	Initial Assessment/Records Search
Phase II	-	Confirmation and Quantification
Phase III	-	Technology Base Development
Phase IV	-	Operations/Remedial Actions

Engineering-Science (ES) was retained by the United States Air Force to conduct the Phase I Records Search at Williams Air Force Base (AFB) under Contract No. F08637 80 G0009 5013. This report contains a summary and an evaluation of the information collected during Phase I of the IRP and recommended follow-on actions. The land areas included as part of the Williams AFB study are as follows:

Main Base Site	4127 acres
Rittenhouse Auxiliary Field	604 acres
Coolidge-Florence Municipal Airport Annex	5 acres
Williams Recreation Annex ("Waterdog")	26 acres

The objective of the first phase of the program is to identify the potential for environmental contamination from past waste disposal practices at Williams AFB, and to assess the potential for contaminant migration. The activities performed as a part of the Phase I study scope included the following:

- Review of site records
- Interviews with personnel familiar with past generation and disposal activities
- Survey of types and quantities of wastes generated
- Determination of current and past hazardous waste treatment, storage, and disposal activities
- Description of the environmental setting at the base
- Review of past disposal practices and methods

- Reconnaissance of field conditions
- Collection of pertinent information from federal, state and local agencies
- Assessment of the potential for contaminant migration
- Development of recommendations for follow-on actions

ES performed the on-site portion of the records search during October, 1983. The following team of professionals were involved:

- R. L. Thoem, Environmental Engineer and Project Manager, MS Sanitary Engineering, 20 years of professional experience
- R. S. McLeod, Hydrogeologist, MS Civil Engineering, 22 years of professional experience
- R. M. Palazzolo, Environmental Engineer, MS Environmental Engineering, 2 years of professional experience

More detailed information on these three individuals is presented in Appendix A.

METHODOLOGY

The methodology utilized in the Williams AFB Records Search began with a review of past and present industrial operations conducted at the base. Information was obtained from available records such as shop files and real property files, as well as interviews with 44 past and present base employees from the various operating areas. Those interviewed included current and past personnel associated with civil engineering, bioenvironmental engineering, fuels management, field maintenance, organizational maintenance, training activities, base equipment and grounds maintenance, entomology, fire protection, fire protection training, property disposal, real property, recreation, and contractors. A listing of interviewee positions with approximate years of service is presented in Appendix B.

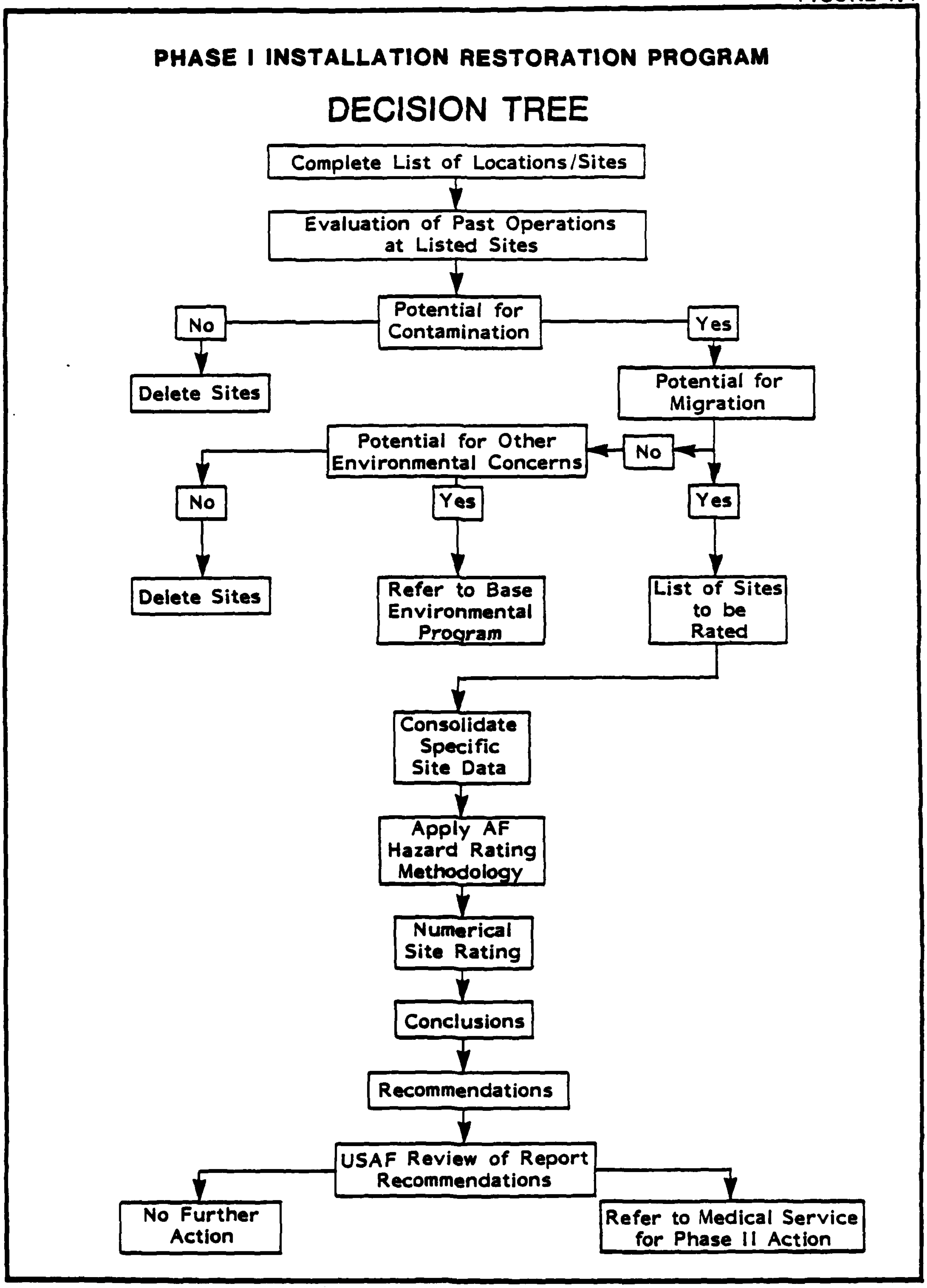
Concurrent with the base interviews, the applicable federal, state and local agencies were reviewed for pertinent base related environmental data. The agencies contacted are listed below and in Appendix B.

- U.S. Environmental Protection Agency, Region IX (San Francisco, CA)
- U.S. Geological Survey, Water Resources Division (Phoenix, AZ)
- U.S. Fish and Wildlife Service, Ecological Services (Phoenix, AZ)
- Arizona Department of Health Services, Bureau of Water Quality Control (Phoenix, AZ)
- Arizona Department of Water Resources (Phoenix, AZ)

The next step in the activity review was to identify all sources of hazardous waste generation and to determine the past management practices regarding the use, storage, treatment, and disposal of hazardous materials from the various sources on the base. Included in this part of the activities review was the identification of all known past disposal sites and other possible sources of contamination such as spill areas.

An overflight of the base was impractical due to the high level of aircraft activity at the installation; therefore, a general ground tour of the identified sites was made by the ES Project Team to gather site-specific information including: (1) general observations of existing site conditions; (2) visual evidence of environmental stress; (3) presence of nearby drainage ditches, canals or surface waters; and (4) visual inspection of these water bodies or dry channel bottoms for any obvious signs of contamination or leachate migration.

A decision was then made, based on all of the above information, whether a potential exists for hazardous material contamination at any of the identified sites using the Decision Tree shown in Figure 1.1. If no potential existed, the site was deleted from further consideration. For those sites where a potential for contamination was identified, a determination of the potential for contaminant migration was made by considering site-specific conditions. If there were no further environmental concerns, then the site was deleted. If there are other environmental concerns, then these were referred to the base environmental program. If the potential for contaminant migration was considered


PHASE I INSTALLATION RESTORATION PROGRAM
DECISION TREE
Complete List of Locations/Sites
Evaluation of Past Operations at Listed Sites
Potential for Contamination
No
Yes
Delete Sites
Potential for Migration
Potential for Other Environmental Concerns
No
No
Yes
Yes
Delete Sites
Refer to Base Environmental Program
List of Sites to be Rated
Consolidate Specific Site Data
Apply AF Hazard Rating Methodology
Numerical Site Rating
Conclusions
Recommendations
USAF Review of Report Recommendations
No Further Action
Refer to Medical Service for Phase II Action

significant, then the site was evaluated and rated using the Hazard Assessment Rating Methodology (HARM). The HARM score indicates the relative potential for environmental contamination at each site.

SECTION 2

INSTALLATION DESCRIPTION

LOCATION, SIZE AND BOUNDARIES

Williams Air Force Base is located approximately 30 miles southeast of Phoenix, Arizona in Maricopa County (Figures 2.1 and 2.2). The base has desert range land bounding the north and east sides and irrigated farmland on the west and south. Several ranges of mountains are within 11 to 35 miles of the base in all directions. The Roosevelt Canal passes along the northwest edge of the installation. Drainage channels, which are dry a large percentage of the time, transport runoff from the base and adjoining land to a major drainage system that parallels the Roosevelt Canal.

The main base comprises 4127 acres of government-owned land (see Figure 2.3). Three remote annexes exist as shown in Figures 2.1 and 2.2 and described below:

- Rittenhouse Auxiliary Field - this annex, located approximately 7 miles southeast of Williams AFB, currently consists of 604 acres (537 acres Air Force-owned). Rittenhouse has been an annex of Williams AFB since 1942. The auxiliary field was used for aircraft landings until about the 1950's. A small mess hall and a covered area (both now demolished) were the only structures placed at the field. Currently, Rittenhouse is used for parasailing and other field/survival training activities by the Air Force and various military units. Due to inactivity at this annex, only 268 acres will continue to be retained after this year's declaration of excess property is processed.
- Coolidge-Florence Municipal Airport Annex - located approximately 28 miles southeast of Williams AFB, this annex consists of 5 acres of land leased from the City of Coolidge since 1962. Air Force facilities at this airport include a shed for fire protection equipment, trailer and navigational aids. The annex

FIGURE 2.1

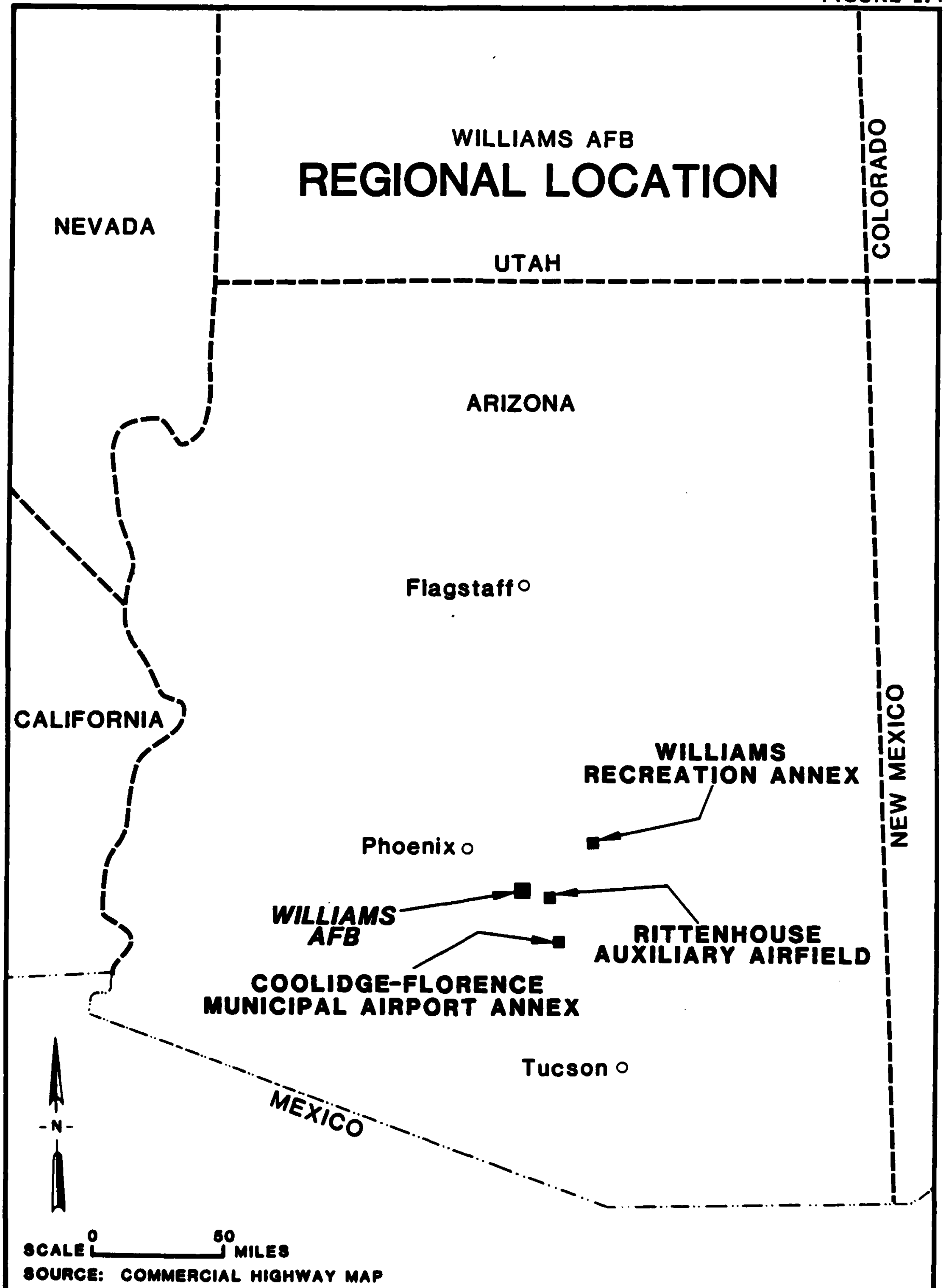
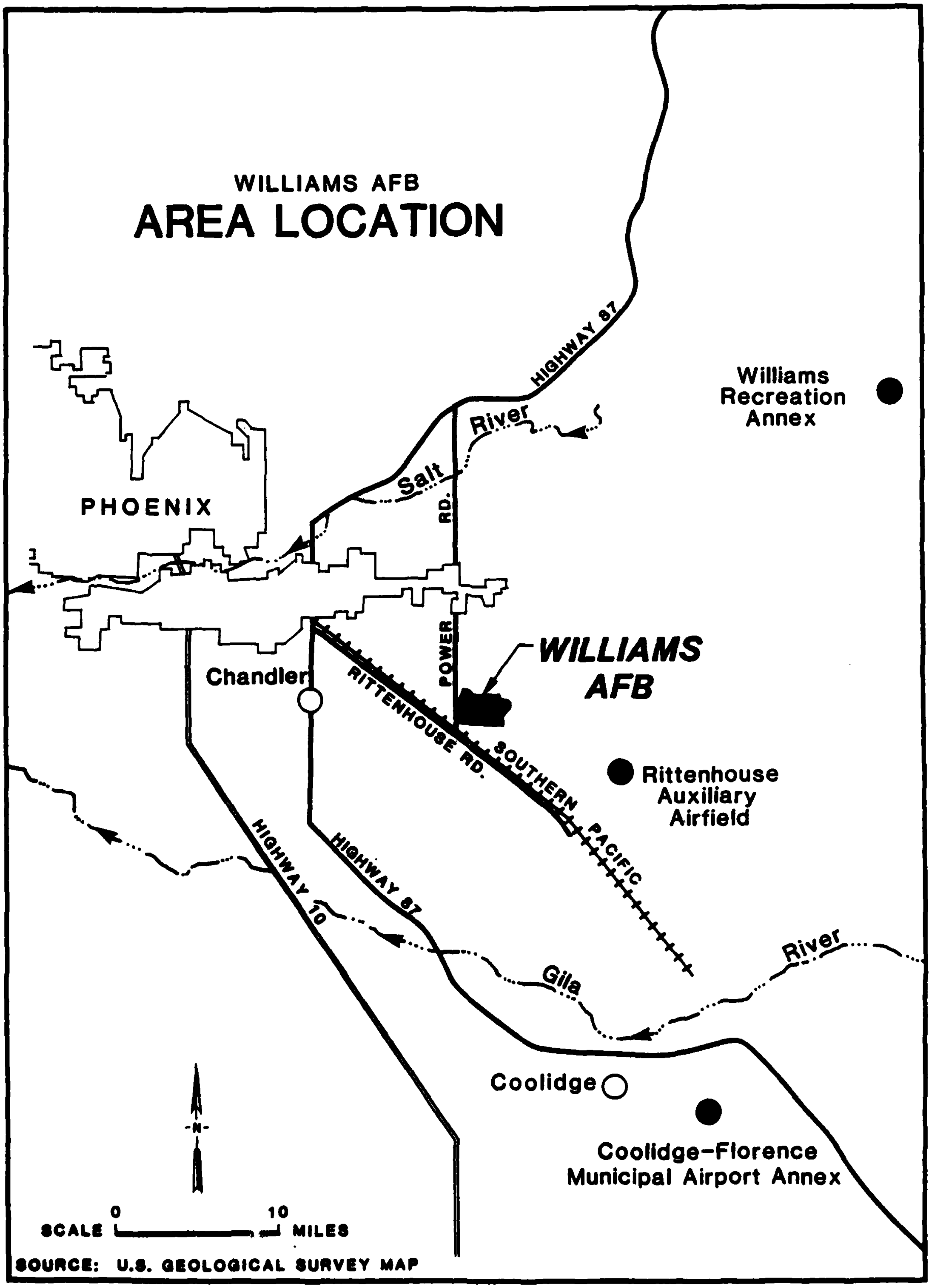
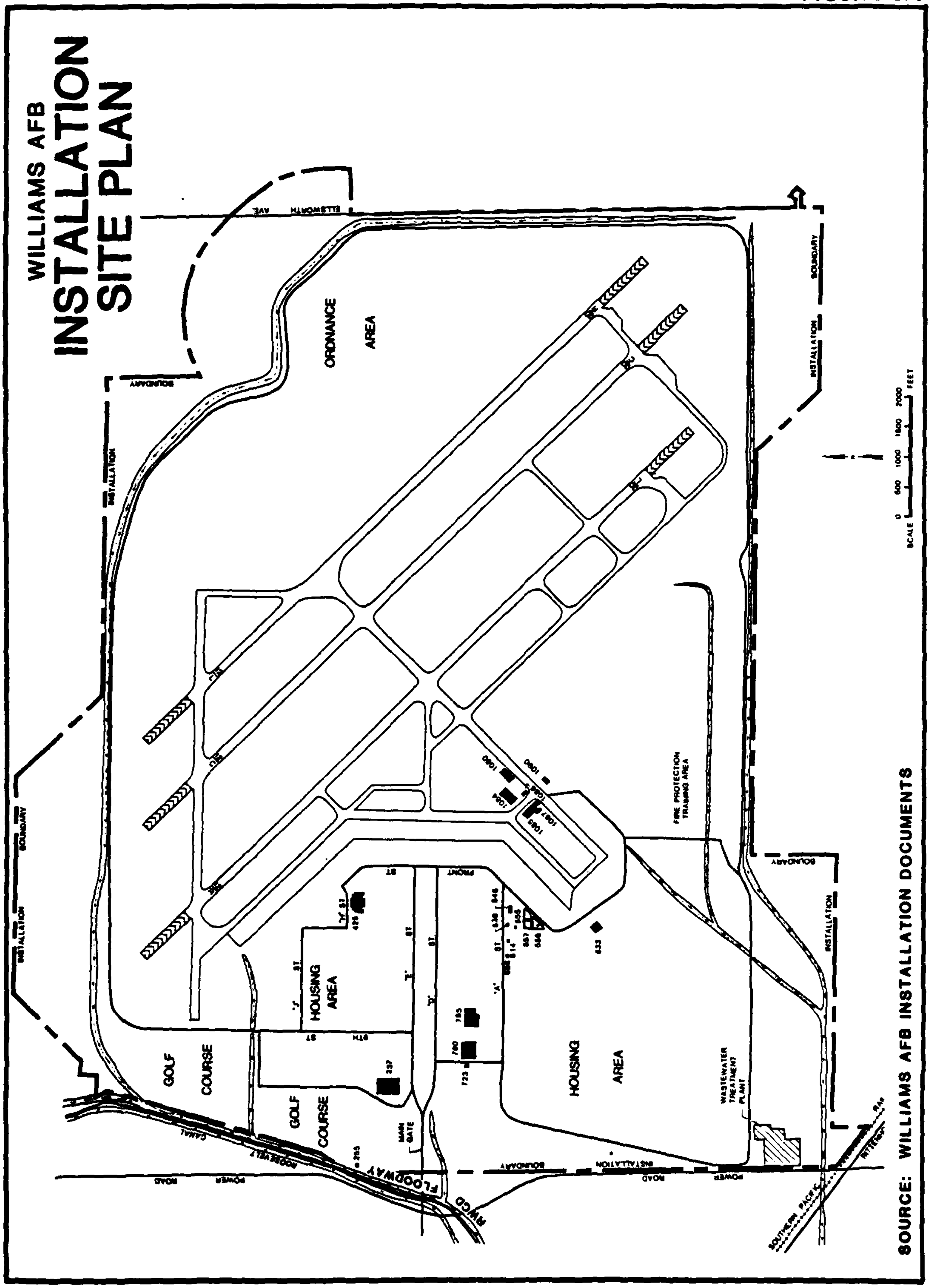

WILLIAMS AFB
REGIONAL LOCATION
NEVADA
UTAH
COLORADO
ARIZONA
Flagstaff
CALIFORNIA
WILLIAMS
RECREATION ANNEX
NEW MEXICO
Phoenix
WILLIAMS
AFB
RITTENHOUSE
AUXILIARY AIRFIELD
COOLIDGE-FLORENCE
MUNICIPAL AIRPORT ANNEX
Tucson
MEXICO
N
SCALE 0 50 MILES
SOURCE: COMMERCIAL HIGHWAY MAP

FIGURE 2.2



ES ENGINEERING-SCIENCE

FIGURE 2.3



SOURCE: WILLIAMS AFB INSTALLATION DOCUMENTS

has been and continues to be used for aircraft "touch and go" training activities.

- Williams Recreation Area ("Waterdog") - The recreation area (26 acres) leased from the U.S. Forest Service by the base since 1957 is located adjacent to Apache Lake, approximately 30 miles northeast of Williams AFB. The "Waterdog" area includes 20 cabins, a recreational building and a supply/equipment shed.

BASE HISTORY

Williams Air Force Base was constructed in 1941 and immediately served as a flying training school. Training using jet aircraft (T-33) started in 1949 at Williams AFB. Pilot training has been the primary activity at Williams throughout its history. Other activities have included bombardier, bomber pilot, instrument bombing specialist and fighter gunnery training schools. In 1961 a new undergraduate pilot training program was initiated by the Air Training Command. A wide variety and significant numbers of aircraft have been based at Williams through the years in support of its training mission. Current aircraft based at Williams include the T-37, T-38, and F-5.

ORGANIZATION AND MISSION

The host unit at Williams Air Force Base is the 82nd Flying Training Wing. Major units within the Wing include Operations, Maintenance, Resource Management, 82nd Air Base Group and the USAF Hospital Williams.

The mission of the 82nd Flying Training Wing is to conduct an undergraduate pilot training program. The Deputy Commander for operations directs all the flying training activities. Providing management of all maintenance resources for the primary mission is the Deputy Commander for Maintenance. All supply, transportation, and other logistical support is under the Deputy Commander for Resource Management. The 82nd Air Base Group manages and maintains all base facilities and service functions. Medical services are provided by the USAF Hospital Williams.

The major tenant organizations at Williams AFB are listed subsequently. Descriptions of the major tenants and their missions are presented in Appendix C.

425th Tactical Fighter Training Squadron

Air Force Human Resources Laboratory

1922nd Communications Squadron

Detachment 528, 3751st Field Training Squadron

Detachment 17, 24th Weather Squadron

Detachment 13, 3314th Management Engineering Squadron

Detachment 1817 Air Force Office of Special Investigations

Area Defense Counsel, Detachment QD5U

USAF, Civil Air Patrol Liaison, AZ

Air Force Commissary Service

Army and Air Force Exchange Service

SECTION 3

ENVIRONMENTAL SETTING

The environmental setting at Williams Air Force Base is described in this section. Primary emphasis is directed toward identifying features that may facilitate movement of hazardous waste contamination off base. Environmentally sensitive conditions pertinent to the study are highlighted at the end of this section.

METEROLOGY

Two climatic features of interest in determining the potential for movement of contaminants are net precipitation and rainfall intensity. Net precipitation is an indicator for the potential of leachate generation and is equal to the difference between annual precipitation and annual lake evaporation. Rainfall intensity is an indicator for the potential of excessive runoff and erosion. The one-year, 24-hour rainfall is used to aid in determining the potential for runoff and erosion.

Net precipitation at Williams AFB is a very low -65 inches. This indicates a very low probability for leachate generation at hazardous waste sites on the base as a result of rainfall. Mean annual precipitation at Williams AFB for the period 1942 to 1981 was 7.15 inches (Tab D Williams AFB documents). Annual lake evaporation for the area is 72 inches (National Oceanic and Atmospheric Administration (NOAA), 1977). Selected meterological data are summarized in Table 3.1.

The one-year, 24-hour rainfall at the base is approximately 1.5 inches (NOAA, 1966) which is low to moderate in intensity.

GEOGRAPHY

Williams AFB is located approximately 30 miles southeast of Phoenix, Arizona in the East Basin of the Salt River Valley Basin. The Salt River Valley Basin is part of the Basin and Range Physiographic

TABLE 3.1
SUMMARY OF SELECTED METEROLOGICAL DATA

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Temperature (°F)													
Mean Daily Max.[1]													
	64	68	72	81	91	100	102	100	97	86	73	65	83
Precipitation (inches)													
Mean[1]													
	0.77	0.65	0.85	0.33	0.11	0.08	0.75	1.20	0.82	0.49	0.47	0.63	7.15
Snowfall (inches)													
Mean[2]													
	0	0	T[3]	0	0	0	0	0	0	0	0	0	0

[1] Based on the period 1942-1981

[2] Based on the period 1946-1981

[3] Trace

Source: Tab D, Meteorological Data, Williams AFB records.

Province which is characterized by north - to northwestward-trending, wide, flat alluvial filled basins that surround and separate steep and rugged low-relief mountain ranges. The basin is bounded by the McDowell, Usery, Superstition, Santan, South and Phoenix mountains (Figure 3.1).

The base is in the Gila River drainage basin which is a tributary to the Colorado River. The Gila River originates in southwest New Mexico and flows generally westward to its confluence with the Colorado River approximately four miles upstream from the Mexican border. The Gila River is about 15 miles south of the base. The Salt River, a major tributary to the Gila, is located approximately 13 miles north of the base. Flow in the Gila and Salt Rivers is intermittent in the region.

The area around the base has historically been agricultural but is now becoming urbanized. The greatest urbanization is occurring west and northwest of the base.

Topography

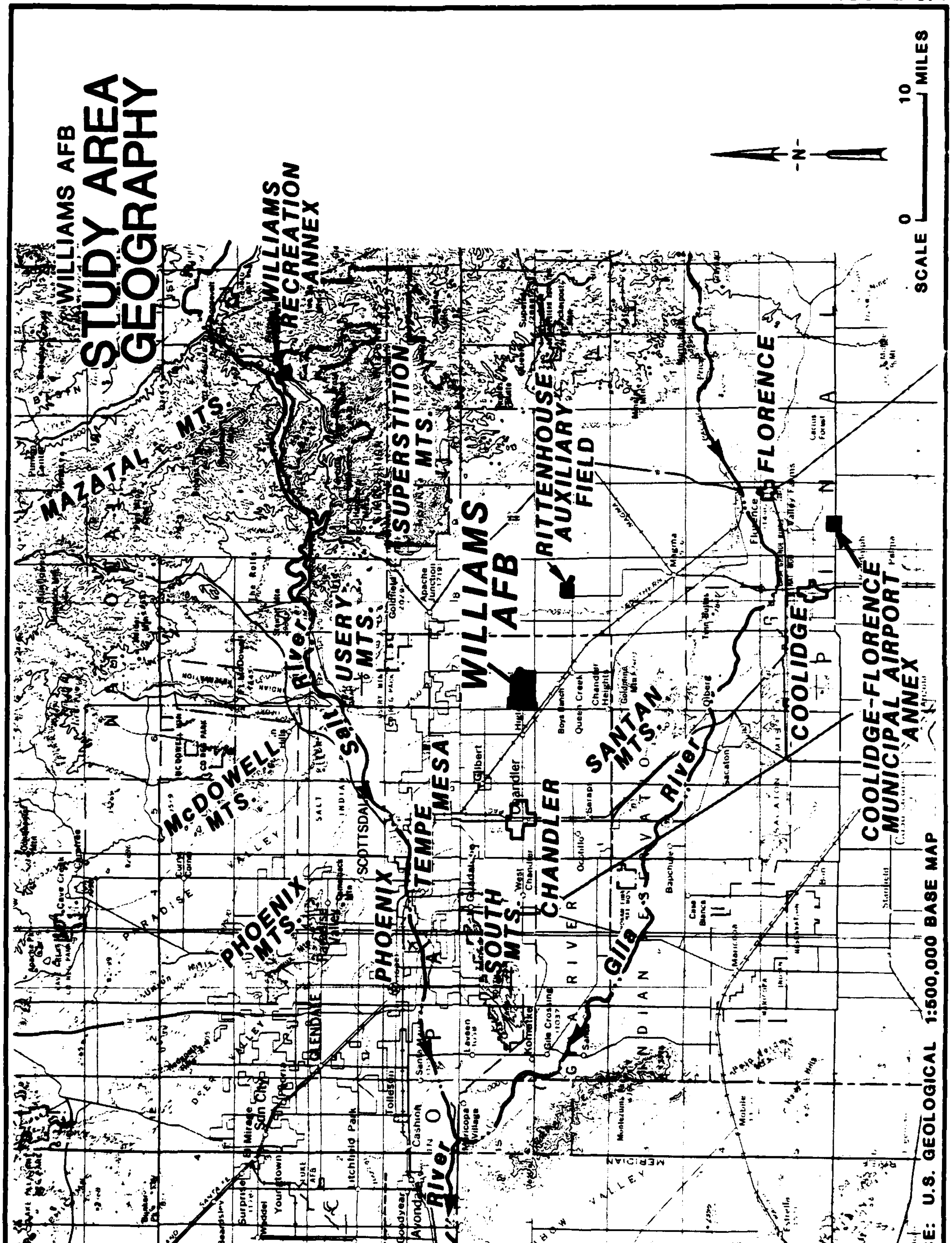
The topography at Williams AFB slopes gently to the west. The highest area on the base is about 1390 feet mean sea level (MSL). This area occurs at the southeast corner of the base. The lowest area is approximately 1326 feet MSL and occurs along the west side of the installation. The land slope on the base is approximately 0.4 percent which is moderate.

The low to moderate one-year, 24-hour rainfall intensity at the base coupled with the moderate land slope provides a moderate degree of erosion potential. Erosion may enhance transport of surface contamination from any hazardous waste sites on the base.

Drainage

Dikes and drainage channels around the north, south and east sides of the base divert storm runoff around and away from the base. One dike and ditch system begins at the southeast corner of the base and drains storm runoff west along the south side of the base. A second system drains storm runoff north along the eastern installation boundary and then west along the north end of the base. These drainage channels empty into the RWCD Floodway that flows southward in the vicinity of the

FIGURE 3.1


WILLIAMS AFB
STUDY AREA
GEOGRAPHY
WILLIAMS
RECREATION
ANNEX
MAZATAL MTS.
SUPERSTITION MTS.
RITTENHOUSE
AUXILIARY
FIELD
FLORENCE
WILLIAMS
AFB
USERY
MTS.
Salt
River
McDOWELL
MTS.
MESA
SANTAN
MTS.
COOLIDGE
COOLIDGE-FLORENCE
MUNICIPAL AIRPORT
ANNEX
PHOENIX
MTS.
SCOTTSDALE
PHOENIX
TEMPE
CHANDLER
SOUTH
MTS.
Gila
River
SCALE
0
10
MILES
N
SOURCE: U.S. GEOLOGICAL 1:500,000 BASE MAP

base and lies between the Roosevelt Water District Irrigation Canal and the base west boundary. The general topography and storm runoff diversion ditch systems at the base are shown in Figure 3.2.

Storm drainage on the base is directed to a combination of open channels and underground drainage structures (Figure 3.3). Open channels are used to drain most of the base. Underground drainage structures are generally limited to the aircraft ramp area. Storm drainage from the base flows either to the drainage channels around the base or directly to the floodway west of the base.

Soils

Two soil associations are prevalent on the base (Figure 3.4). The Mohall-Continue Association covers most of the northern one-half of the installation. This soil association consists of clay, clay loam and loam with a permeability on the order of 10^{-4} centimeters per second (cm/sec). The Gilman-Estrella-Avondale Association covers the southern one-half of the base. This soil association consists of clay loam, sandy loam and loam with a permeability of approximately 10^{-3} cm/sec. Since the soils on the base are moderately permeable, there is a good potential for rainfall and runoff to infiltrate to the base subsurface.

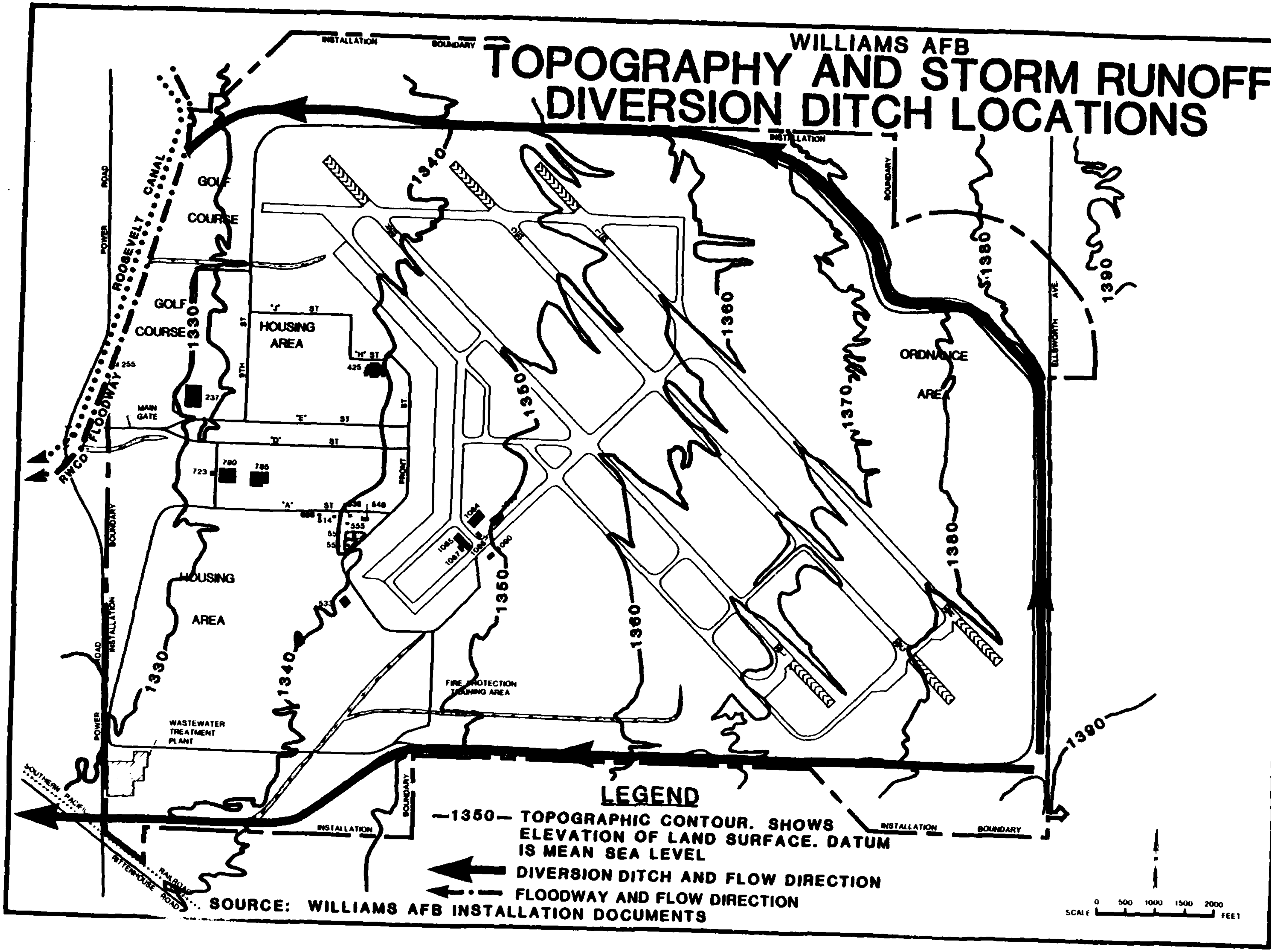
GEOLOGY

Stratigraphy

Williams AFB is underlain by Precambrian age rocks, volcanic rocks believed to be of Tertiary age, and alluvial deposits of Tertiary and Quaternary ages. The Precambrian rocks form the basement upon which the younger geologic materials were deposited. The depth below land surface to these rocks in the vicinity of the base is unknown. The Precambrian rocks are overlain by the volcanic rocks. The depth below land surface to the volcanics is approximately 6,600 feet in the vincity of the base (EG&G Idaho, 1979). Alluvial deposits overlie the volcanic rocks.

The alluvial deposits at the base include unconsolidated alluvial deposits underlain by consolidated alluvium (Arizona Bureau of Mines, 1969). The unconsolidated deposits consist of interfingering layers of sand, gravel, silt and clay. The consolidated alluvium consists of claystone, siltstone, sandstone and anhydrite. The general stratigraphy in the vicinity of the base is given in Table 3.2.

FIGURE 3.2



WILLIAMS AFB
TOPOGRAPHY AND STORM RUNOFF DIVERSION DITCH LOCATIONS

LEGEND

—1350— TOPOGRAPHIC CONTOUR. SHOWS ELEVATION OF LAND SURFACE. DATUM IS MEAN SEA LEVEL

DIVERSION DITCH AND FLOW DIRECTION

FLOODWAY AND FLOW DIRECTION

SOURCE: WILLIAMS AFB INSTALLATION DOCUMENTS

FIGURE 3.3

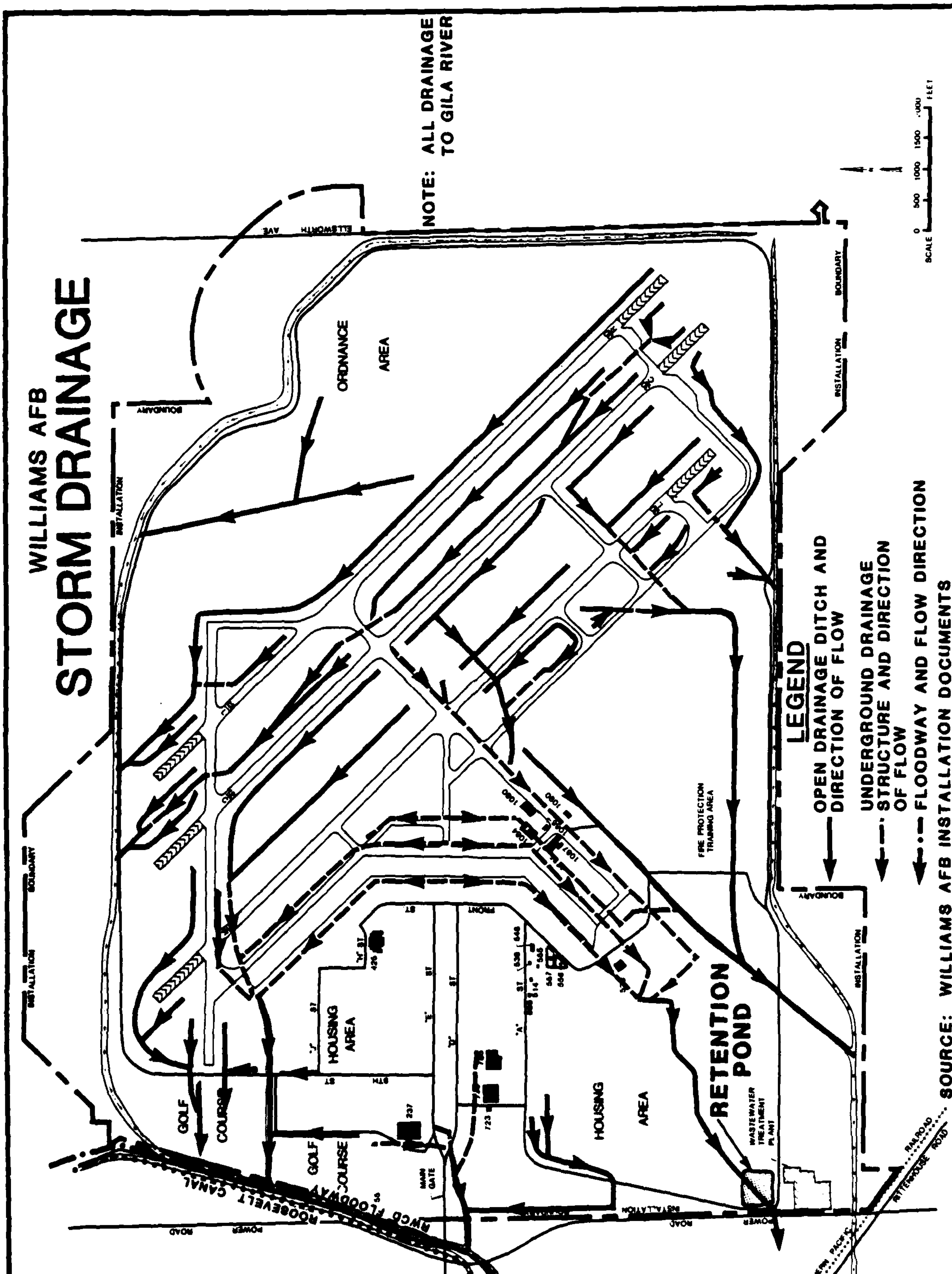
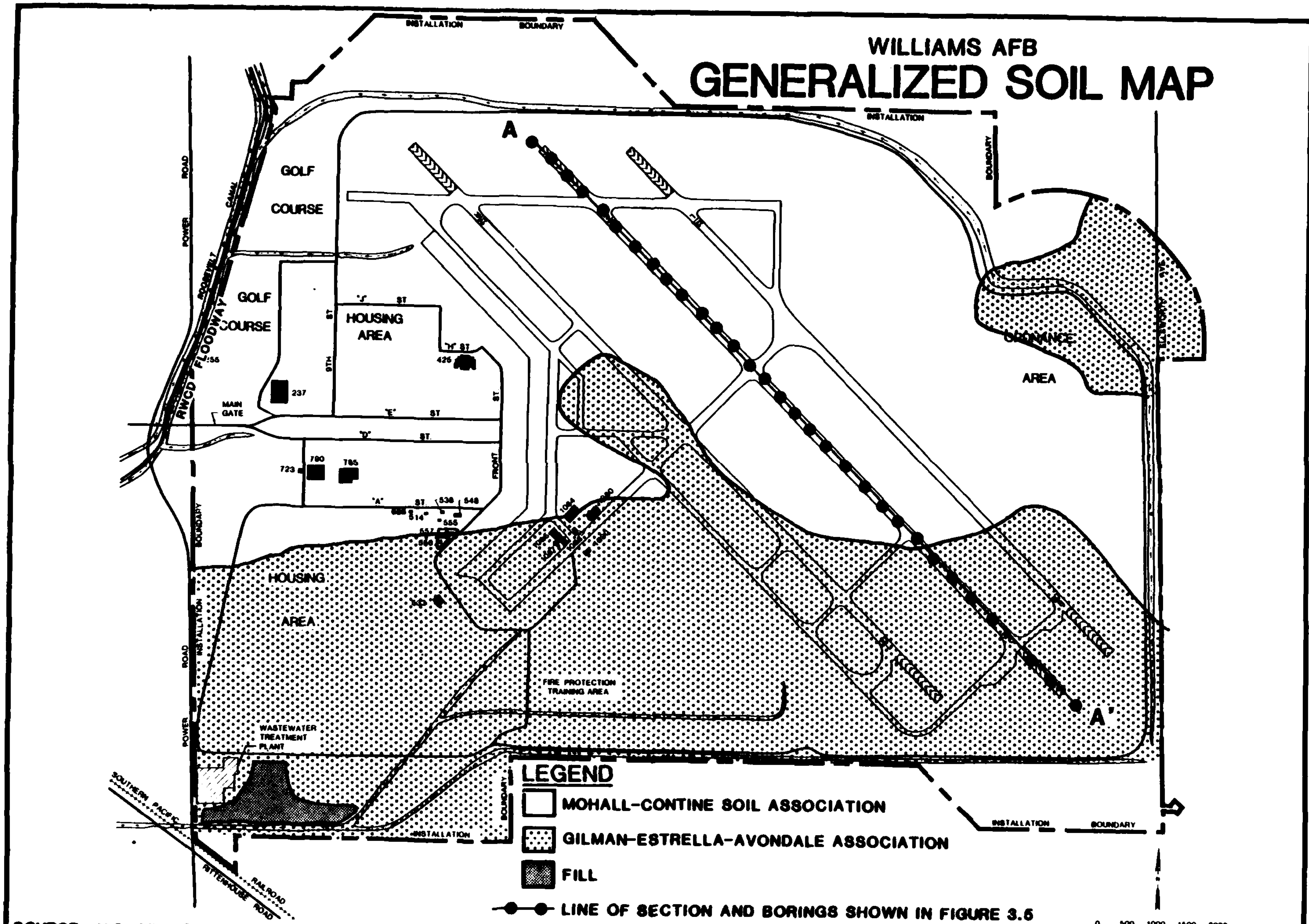

WILLIAMS AFB
STORM DRAINAGE
NOTE: ALL DRAINAGE TO GILA RIVER
ORDNANCE AREA
HOUSING AREA
HOUSING AREA
GOLF COURSE
GOLF COURSE
RETENTION POND
WASTEWATER TREATMENT PLANT
FIRE PROTECTION TRAINING AREA
MAIN GATE
ELLSWORTH AVE
INSTALLATION BOUNDARY
ROOSEVELT CANAL
RWCD FLOODWAY
POWER ROAD
RAILROAD
RITTENHOUSE ROAD
SOUTHERN PACIFIC
LEGEND
OPEN DRAINAGE DITCH AND DIRECTION OF FLOW
UNDERGROUND DRAINAGE STRUCTURE AND DIRECTION OF FLOW
FLOODWAY AND FLOW DIRECTION
SOURCE: WILLIAMS AFB INSTALLATION DOCUMENTS
SCALE 0 500 1000 1500 FEET

FIGURE 3.4

WILLIAMS AFB
GENERALIZED SOIL MAP



SOURCE: U.S. AIR FORCE DOCUMENTS AND U.S. SOIL CONSERVATION SERVICE (1974)

TABLE 3.2
GENERALIZED STRATIGRAPHY

System	Group or Formation	Thickness (Feet)	Dominant Lithology
Tertiary and younger	Alluvium	1,100	Sand, gravel, silt and clay
		1,200	Claystone
		1,200	Siltstone and anhydrite
		3,100	Claystone, siltstone and sandstone
	Volcanics	>3,800	Dacite
	Older rocks not studied		

Source: EG&G Idaho, 1979

The upper 1,000 feet of alluvial deposits is of greatest interest for this study. Water from these deposits is used to supply the base. Sand, gravel, clay and sandy clay are the dominant lithologies on the west side of the base. The lithologic log for base water supply Well Number 6 located on the west side of the base is given in Table 3.3.

The near-surface unconsolidated deposits are sands, silts and clays. Clay or silt is generally found at the surface and is underlain by sand at depth of four to seven feet. A cross-section along Runway 12-30C giving the typical distribution of near-surface deposits in that area is shown in Figure 3.5.

Structure

Arizona was the scene of much faulting, folding and volcanism during Tertiary and early Quaternary times. Down-faulted basins and up-faulted mountain ranges were created in the Basin and Range Province during this period. Faulting in the Basin and Range Province was most active during Tertiary time between 6 million and 20 million years ago. Faulting diminished during early Quaternary time 2 to 3 million years ago.

Uplifting and downfaulting of the land surface produced mountains and valleys in the area around the base. The valleys were subsequently buried with alluvial debris derived from the mountains and broad alluvial basins were formed.

HYDROLOGY

Subsurface Hydrology

The unconsolidated alluvial deposits in the East Basin are the source for ground water in the area of the base. These deposits consist of sand, gravel, silt and clay (Arizona Bureau of Mines, 1969).

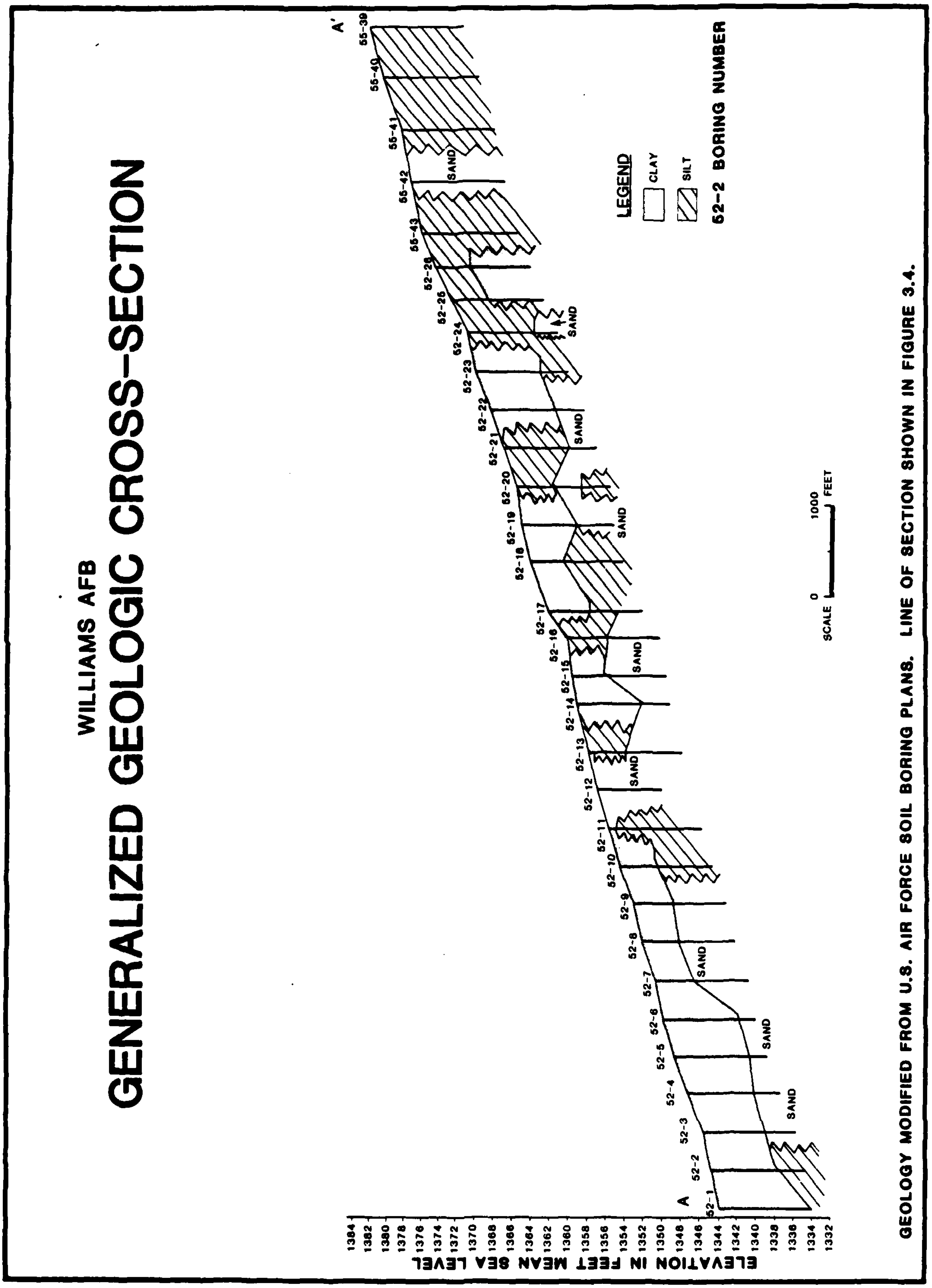
The water table depicts the upper limit of the saturated geologic materials in the area. The water table was near the land surface prior to development of the ground-water reservoir. The water table during 1976 was about 950 feet MSL at the base or about 400 feet below ground surface (Figure 3.6). The large reductions in water levels have been the result of pumping water for irrigation and public supply.

Ground-water flow directions were from east to west in the area of the base prior to development of ground water for supply (Arizona Bureau

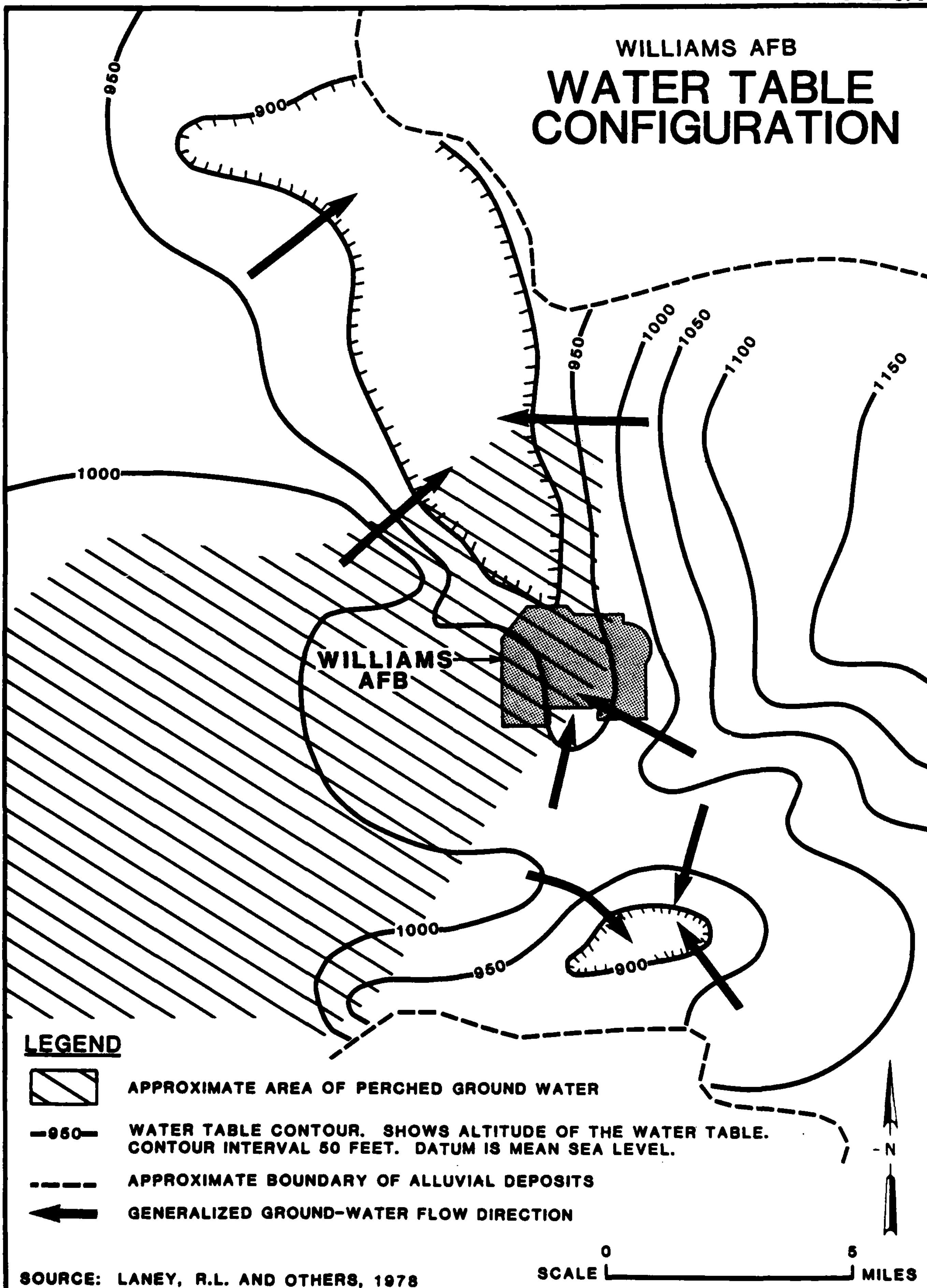
TABLE 3.3
LITHOLOGIC LOG FOR WATER SUPPLY WELL NO. 6

Depth in Feet Below Land Surface	Lithology
0 - 15	Soil
15 - 38	Sand, gravel and clay
38 - 145	Sand, clay and gravel
145 - 202	Sand, clay and gravel streaks
202 - 276	Streaks of sand, clay, gravel and hard sand
276 - 369	Clay with streaks of gravel and hard sand
369 - 755	Brown sandy clay with streaks of gravel
755 - 810	Sandy clay with streaks of gravel and hard sand
810 - 1000	Clay with streaks of sand and gravel.

FIGURE 3.5



WILLIAMS AFB
GENERALIZED GEOLOGIC CROSS-SECTION
A
A'
ELEVATION IN FEET MEAN SEA LEVEL
1384
1382
1380
1378
1376
1374
1372
1370
1368
1366
1364
1362
1360
1358
1356
1354
1352
1350
1348
1346
1344
1342
1340
1338
1336
1334
1332
52-1
52-2
52-3
52-4
52-5
52-6
52-7
52-8
52-9
52-10
52-11
52-12
52-13
52-14
52-15
52-16
52-17
52-18
52-19
52-20
52-21
52-22
52-23
52-24
52-25
52-26
55-43
55-42
55-41
55-40
55-39
SAND
LEGEND
CLAY
SILT
52-2 BORING NUMBER
SCALE
0
1000
FEET
GEOLOGY MODIFIED FROM U.S. AIR FORCE SOIL BORING PLANS. LINE OF SECTION SHOWN IN FIGURE 3.4.


WILLIAMS AFB
WATER TABLE CONFIGURATION
950
900
950
1000
1050
1100
1150
1000
WILLIAMS AFB
1000
950
900
LEGEND
APPROXIMATE AREA OF PERCHED GROUND WATER
—950— WATER TABLE CONTOUR. SHOWS ALTITUDE OF THE WATER TABLE. CONTOUR INTERVAL 50 FEET. DATUM IS MEAN SEA LEVEL.
APPROXIMATE BOUNDARY OF ALLUVIAL DEPOSITS
GENERALIZED GROUND-WATER FLOW DIRECTION
N
SCALE 0 5 MILES
SOURCE: LANEY, R.L. AND OTHERS, 1978

of Mines, 1969). Ground water recharge from runoff generally occurred at the base of the mountains east of Williams AFB with subsequent westward movement. Additional recharge occurred by seepage of surface waters.

Two areas of depressed ground-water levels were evident in 1976 (Figure 3.6). One area occurred approximately four miles south of the base; another in the vicinity of the base extended north for more than 10 miles. The depressed water levels are primarily the result of heavy ground-water pumping for irrigation. Regional ground-water flow was toward these areas.

An area of perched water that includes approximately the western one-half of the base exists in the ground-water reservoir (Figure 3.6). The perched water probably results from less permeable silts and clays underlying more permeable sandy clays in this area. The perched water level at the base was about 200 feet below land surface in the spring of 1982 (U.S. Geol. Survey, 1982). The degree of continuity in the perched water table is unknown.

Surface Hydrology

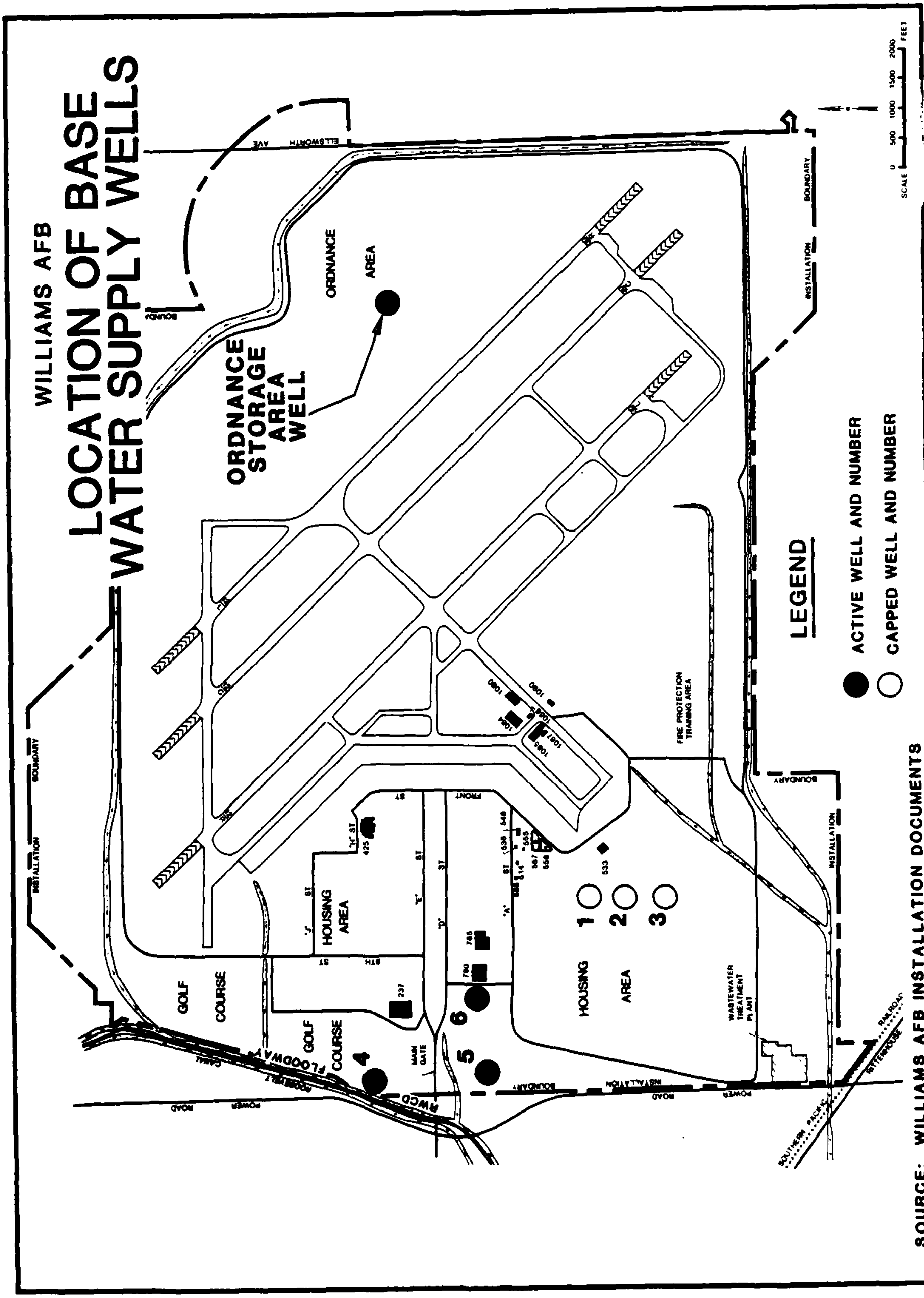
Williams AFB is drained by a combination of open channels and drainage structures that discharge to the RWCD Floodway adjacent to the Roosevelt Water District Irrigation Canal. The floodway does not traverse the base.

Drainage control structures at the base and east of the base offer flood protection to the base. Flood control dikes and drainage ditches around the north, east and south sides of the base intercept and divert runoff from the watershed east of the base (see Figure 3.2). Additionally, a series of detention dams approximately four miles east of Williams AFB aid in controlling runoff in the vicinity of the base.

Flooding at the base can be expected to be minimal. The installation lies between the 100-year and 500-year flood level for streams in the Gila River Basin (U.S. Department of Housing and Urban Development, 1979).

WATER USE

Williams AFB receives its water supply from deep wells located on the base (Figure 3.7). These wells are referred to as Well No. 4, Well


WILLIAMS AFB
LOCATION OF BASE WATER SUPPLY WELLS
ORDNANCE STORAGE AREA WELL
ORDNANCE AREA
LEGEND
ACTIVE WELL AND NUMBER
CAPPED WELL AND NUMBER
SCALE 0 500 1000 1500 2000 FEET
INSTALLATION BOUNDARY
ELLSWORTH AVE
GOLF COURSE
HOUSING AREA
MAIN GATE
FLOODWAY
RWCD
POWER ROAD
FIRE PROTECTION TRAINING AREA
WASTEWATER TREATMENT PLANT
SOUTHERN PACIFIC RAILROAD
FRONT ST
'A' ST
'D' ST
'E' ST
'H' ST
'J' ST
9TH ST
1
2
3
4
5
6
237
429
533
780
785
1080
1084
1085
1087
SOURCE: WILLIAMS AFB INSTALLATION DOCUMENTS

No. 5, Well No. 6 and the Ordnance Storage Area Well. Wells 4, 5 and 6 are high capacity wells located on the west side of the base. The Ordnance Storage Area Well is a low capacity well located in the ordnance storage area and used to supply sanitation water to that area. The wells vary in depth between 500 and 1,000 feet. Well construction data are summarized in Table 3.4.

Three wells that were previously used for water supply have been capped and abandoned. These wells, Nos. 1, 2 and 3, were located in the housing area (Figure 3.7). It is probable that the wells could not continue to supply the required water for the base as regional water levels dropped. The available data for the wells are summarized in Table 3.4.

Approximately 90 permitted irrigation and domestic supply wells are located within two miles of the installation boundaries. These wells generally range between 200 and 1,200 feet in depth. The general location of these wells is shown in Figure 3.8.

WATER QUALITY

Williams AFB is authorized to discharge wastewater from its treatment plant to the Roosevelt Water District Irrigation Canal. This water is discharged to the canal through Outfall 001 (Figure 3.9) which is permitted under the National Pollutant Discharge Elimination System. Wastewater discharged from the treatment plant is in compliance with permit requirements. Discharge data for 1983 that were monitored under the permit are summarized in Table 3.5.

Wastewater from the base is discharged to the canal only when it is not being used for other purposes. Treated effluent is used most of the time for watering the base golf course.

Arizona water quality standards for surface waters requires that toxic substances not be present at concentrations which are deleterious to human, animal, plant or aquatic life, or at concentrations sufficient to interfere with designated protected uses (Chapter 21, Arizona Administrative Rules and Regulations, 1981). Water discharged from the treatment plant is used for irrigation and is, therefore, subject to water quality standards for irrigation uses. Specific Arizona water quality standards for irrigation waters are given in Table 3.6.

TABLE 3.4

WELL CONSTRUCTION SUMMARY[1]
WILLIAMS AFB

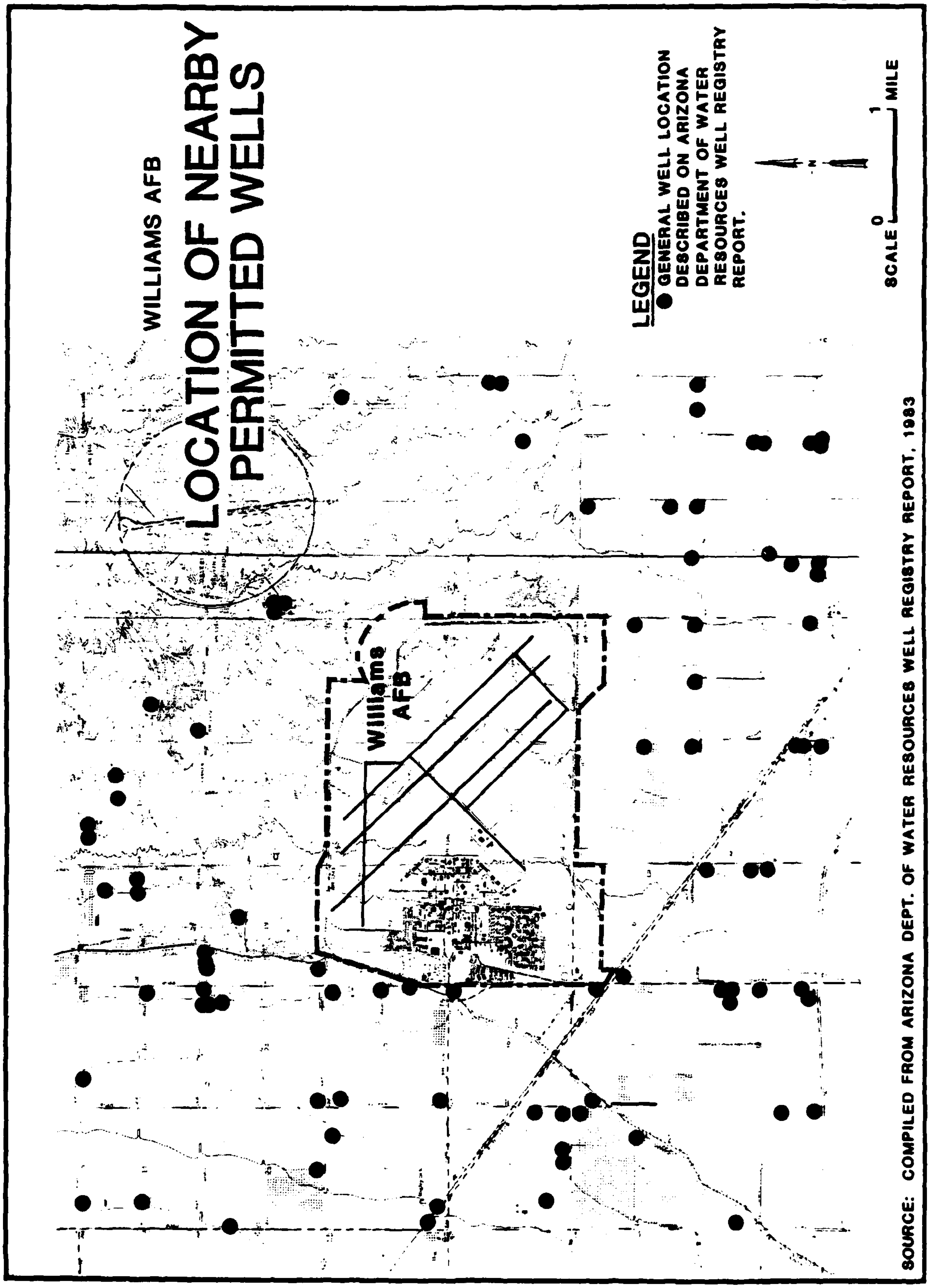
Well	Well Depth (ft)	Top of Casing Below Land Surface (ft)	Bottom of Casing Below Land Surface (ft)	Diameter of Casing (in)	Top of Open Interval Below Land Surface (ft)	Bottom of Open Interval Below Land Surface (ft)	Diameter of Open Interval (in)	Rated Pumping Capacity (gpm)
1	500	-	-	-	-	-	16	1200[2]
2	428	-	-	-	-	-	16	1200[2]
3	800	-	-	-	-	-	20	1800[2]
4	854	0	24	30	294	486	20	1700[3]
		0	486	20	492	854	18	
		486	492	20-18				
		492	854	18				
5	1000	0	25	30	600	1000	20	1725[3]
		0	1000	20				
6	1000	0	24	30	700	1000	20	1500[3]
		0	1000	20				
Ordnance Storage Area	500	-	-	12	-	-	-	37[3]

(1) Data from U.S. Air Force documents unless otherwise noted.

(2) Written Comm. (J. I. Schopf, February, 1984)

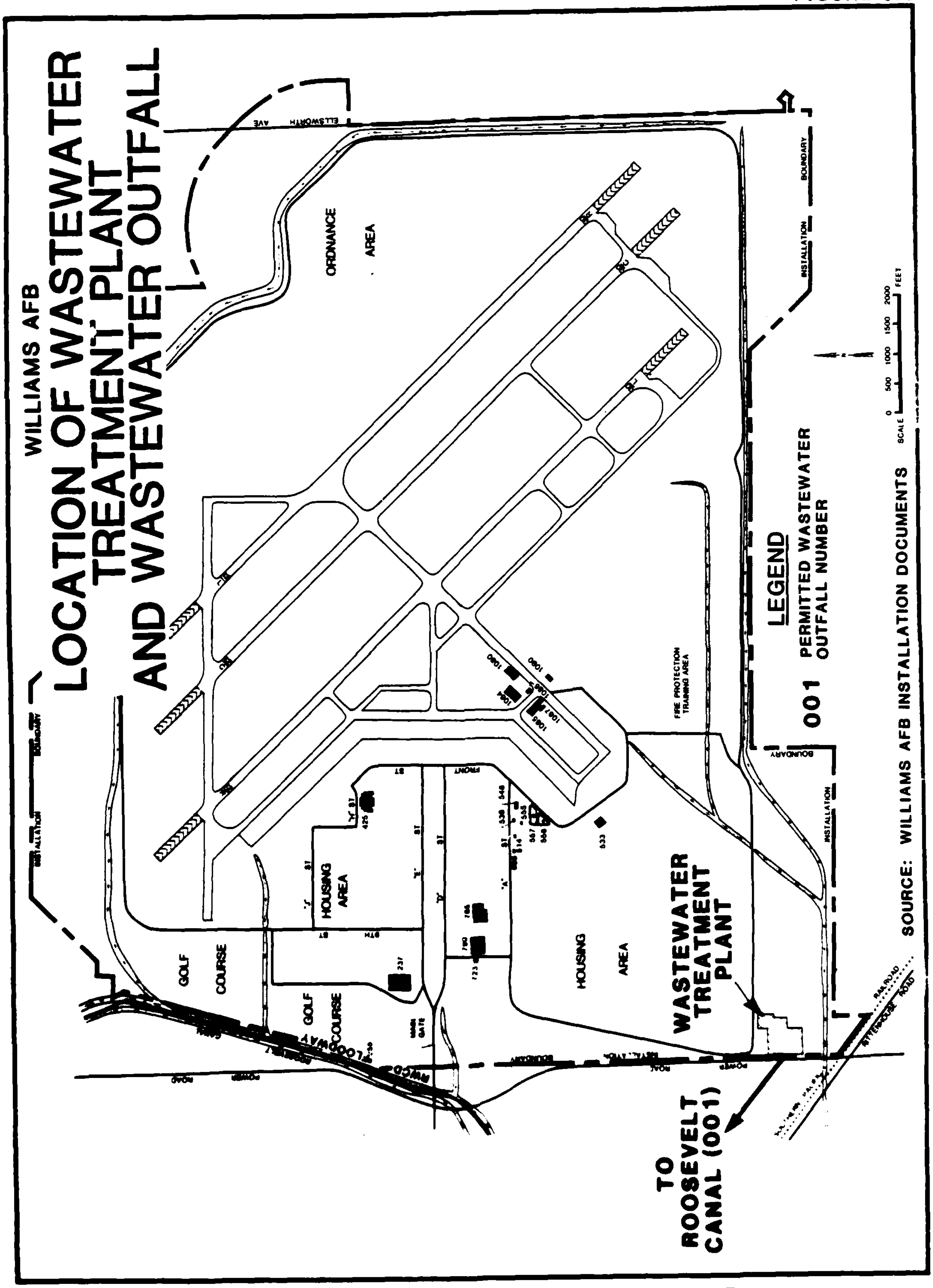
(3) Arizona Dept. of Water Resources Well Registry Report, 1983.

FIGURE 3.8



WILLIAMS AFB
LOCATION OF NEARBY PERMITTED WELLS
LEGEND
GENERAL WELL LOCATION DESCRIBED ON ARIZONA DEPARTMENT OF WATER RESOURCES WELL REGISTRY REPORT.
SCALE 0 1 MILE
N
Williams AFB
SOURCE: COMPILED FROM ARIZONA DEPT. OF WATER RESOURCES WELL REGISTRY REPORT, 1983

FIGURE 3.9



WILLIAMS AFB
LOCATION OF WASTEWATER TREATMENT PLANT AND WASTEWATER OUTFALL
ELLSWORTH AVE
ORDNANCE AREA
INSTALLATION BOUNDARY
GOLF COURSE
HOUSING AREA
FRONT
FIRE PROTECTION TRAINING AREA
WASTEWATER TREATMENT PLANT
POWER ROAD
MAIN GATE
RAILROAD
RITTENHOUSE ROAD
TO ROOSEVELT CANAL (001)
LEGEND
001 PERMITTED WASTEWATER OUTFALL NUMBER
SCALE 0 500 1000 1500 2000 FEET
SOURCE: WILLIAMS AFB INSTALLATION DOCUMENTS

TABLE 3.5
SUMMARY OF NPDES PERMIT MONITORING DATA FOR 1983

Parameter	Month	Quantity or Loading (Kg/day) 30-Day Average	7-Day Average	Quality or Concentration 30-Day Average	7-Day Average	Daily Maximum	Measmt. Units
Biochemical	Jan	5	20	2	4	-	mg/l
Oxygen	Feb	5	9	2	3	-	mg/l
Demand	Mar	5	16	2	4	-	mg/l
5-Day	Apr	4	4	2	2	-	mg/l
	May	7	27	3	5	-	mg/l
	Jun	8	13	3	3	-	mg/l
	Jul	8	16	3	4	-	mg/l
	Aug	11	16	4	5	-	mg/l
	Sep	8	16	3	4	-	mg/l
	Oct	6	11	3	4	-	mg/l
	Nov	6	12	4	4	-	mg/l
	Dec	5	15	4	7	-	mg/l
Permit Requirement		38	114	10	15	-	mg/l
Suspended	Jan	27	41	12	16	-	mg/l
Solids	Feb	25	32	11	12	-	mg/l
	Mar	27	30	12	13	-	mg/l
	Apr	32	41	17	19	-	mg/l
	May	23	34	10	13	-	mg/l
	Jun	40	50	15	18	-	mg/l
	Jul	26	34	10	13	-	mg/l
	Aug	32	34	12	14	-	mg/l
	Sep	34	45	13	17	-	mg/l
	Oct	23	38	12	17	-	mg/l
	Nov	21	29	14	17	-	mg/l
	Dec	22	28	19	22	-	mg/l
Permit Requirement		38	114	10	15	-	mg/l
Settleable	Jan	-	-	<.1	<.1	<.1	ml/l
Solids	Feb	-	-	<.1	<.1	<.1	ml/l
	Mar	-	-	.1	.1	.1	ml/l
	Apr	-	-	.1	.1	.1	ml/l
	May	-	-	<.1	<.1	<.1	ml/l
	Jun	-	-	<.1	-	<.1	ml/l
	Jul	-	-	.1	.1	.1	ml/l
	Aug	-	-	.1	.1	.1	ml/l
	Sep	-	-	<.1	-	.1	ml/l
	Oct	-	-	.1	.1	.1	ml/l
	Nov	-	-	.1	.1	.1	ml/l
	Dec	-	-	<.1	<.1	<.1	ml/l
Permit Requirement		-	-	.1	-	.2	ml/l

TABLE 3.5 (Continued)
SUMMARY OF NPDES PERMIT MONITORING DATA FOR 1983

Parameter	Month	Quantity or Loading (Kg/day) 30-Day Average	Quantity or Loading (Kg/day) 7-Day Average	Quality or Concentration 30-Day Average	Quality or Concentration 7-Day Average	Quality or Concentration Daily Maximum	Measmt. Units
Fecal	Jan	-	-	11	12	12	no./100 ml
Coliform	Feb	-	-	8	8	8	no./100 ml
Bacteria	Mar	-	-	8	10	10	no./100 ml
	Apr	-	-	6	8	8	no./100 ml
	May	-	-	5	7	7	no./100 ml
	Jun	-	-	5	6	6	no./100 ml
	Jul	-	-	5	5	5	no./100 ml
	Aug	-	-	4	5	5	no./100 ml
	Sep	-	-	4	7	7	no./100 ml
	Oct	-	-	2	3	3	no./100 ml
	Nov	-	-	4	3	5	no./100 ml
	Dec	-	-	3	3	4	no./100 ml
Permit Requirement		-	-	200	400	2,000	no./100 ml
					Minimum	Maximum	
pH	Jan	-	-		7.2	7.5	Std. Units
	Feb	-	-		7.1	7.5	Std. Units
	Mar	-	-		7.1	7.5	Std. Units
	Apr	-	-		7.2	7.6	Std. Units
	May	-	-		7.2	7.4	Std. Units
	Jun	-	-		7.1	7.5	Std. Units
	Jul	-	-		7.2	7.5	Std. Units
	Aug	-	-		7.2	7.5	Std. Units
	Sep	-	-		7.3	7.5	Std. Units
	Oct	-	-		7.2	7.4	Std. Units
	Nov	-	-		7.2	7.5	Std. Units
	Dec	-	-		7.2	7.5	Std. Units
Permit Requirement		-	-		6.5	8.6	Std. Units

Source: BES Files, Williams AFB installation documents.

TABLE 3.6
ARIZONA WATER QUALITY LIMITS
FOR IRRIGATION WATER

Parameter	Limit
Fecal coliform, maximum allowable limits (units/100ml)	
Geometric mean (5 sample min.)	1000
Ten percent of samples for 30-day period	2000
Single sample	4000
pH allowable limits (standard units)	
Maximum	9.0
Minimum	4.5
Trace substances, maximum allowable limits, (mg/l)	
Arsenic	2.00
Boron	1.00
Cadmium	0.05
Chromium (hexavalent and trivalent)	1.00
Copper	5.00
Lead	10.00
Manganese	10.00
Selenium	0.02
Zinc	10.00

Source: Chapter 21, Arizona Administrative Rules and Regulations, 1981.

The quality of water discharged from the wastewater treatment plant is satisfactory and meets Arizona water quality limits for those parameters measured (Table 3.7).

Water from wells on the base is of good quality (Table 3.8). The water from all wells is within primary drinking water standards for those parameters investigated. Primary standards are required standards for drinking water supplies. Secondary standards address the aesthetic quality of drinking water and on a few occasions they have been exceeded.

SATELLITE FACILITIES

Williams AFB operates three satellite facilities. One, Rittenhouse Auxiliary Field, is located about seven miles southeast of the base. A second, Coolidge-Florence Municipal Airport Annex is located about 28 miles south of the base. The third, "Waterdog", is a recreation area located about 30 miles northeast of Williams AFB.

Rittenhouse Auxiliary Field

Rittenhouse Auxiliary Field is located in a physiographic and geologic setting similar to the base. The field is in the East Basin and is bounded by low-relief mountains. Precipitation received at the field is similar to that received at the base.

There is no water supply well at the field.

Coolidge-Florence Municipal Airport Annex

Coolidge-Florence Municipal Airport Annex is located in the Basin and Range Province but is not in the East Basin. The physiography and geology, however are similar to that at the base. Precipitation received at the annex is similar to that received at Williams AFB. Water is supplied to the Williams AFB facilities at the municipal airport by the water system which serves other potable water needs at Coolidge-Florence.

Waterdog Recreation Area

Waterdog Recreation Area is located in the Mazatal Mountains northeast of the base. Precambrian rocks occur at or very near the

TABLE 3.7

SUMMARY OF SELECTED CHEMICAL ANALYSES FOR WASTEWATER DISCHARGE(1)

Date	Sample Type	Chemical Oxygen Demand	Total Dissolved Solids	Oil and Grease	Total Boron (1.00)(2)	Total Cadmium (0.050)(2)	Total Chromium (1.00)(2)	Hexavalent Chromium	Total Silver	Total Phenols	Total Cyanide	Total Lead (10.00)(2)	Total Zinc (10.00)(2)	Surfactants	pH (4.5-9.0)(2)
2/6/77	Comp.	2,750	911	1.0	<0.5	<0.010	<0.050	<0.050	<0.010	0.025	<0.010	--	--	4.6	7.2
8/8/77	Comp.	138	696	<0.30	<0.5	<0.010	<0.050	<0.050	<0.010	0.012	0.030	--	--	5.2	7.3
10/19/77	Grab	735	--	7.0	--	--	--	--	--	--	--	--	--	600	--
3/6/78	Comp.	126	710	3.6	<0.5	<0.010	<0.050	<0.050	<0.010	0.060	0.020	--	--	3.0	7.2
4/20/83	Comp.	37	1,360	1.9	--	<0.010	<0.050	<0.050	<0.010	0.040	<0.010	<0.050	0.130	0.4	--

(1) Analyses in milligrams per liter except pH which is in standard units.
(2) Arizona water quality limit for irrigation water.

Source: BES Files, Williams AFB installation documents.

TABLE 3.8

SUMMARY OF SELECTED CHEMICAL ANALYSES FOR WATER (1)

		Selected Primary Drinking Water Standards										Selected Secondary Drinking Water Standards						
Source	Sample Date	Arsenic (0.050)	Barium (1.00)	Cadmium (0.010)	Chromium (0.050)	Fluoride (1.4-2.4)	Lead (0.050)	Mercury (0.002)	Nitrates (10)	Selenium (0.010)	Silver (0.050)	Chloride (250)	Copper (1.00)	Iron (0.3)	Manganese (0.050)	pH (6.5-8.5)	Sulfate (250)	Total Dissolved Solids (500)
Ordnance Area Well	11/29/77	<0.010	<1.00	<0.010	<0.050	1.0	<0.050	<0.002	0.5	<0.010	<0.010	--	--	--	--	--	--	--
	11/21/79	<0.010	<1.00	<0.010	<0.050	0.4	<0.020	<0.002	3.3	<0.010	<0.010	--	--	--	--	--	--	--
	4/20/82	<0.010	<0.5	<0.005	<0.010	0.3	<0.020	<0.001	1.8	<0.005	<0.020	44	<0.050	0.18	<0.050	8.0	48	270
	7/19/83	<0.010	<0.2	<0.010	<0.050	0.2	<0.020	<0.001	0.9	<0.010	<0.010	36	0.022	0.15	<0.050	--	42	307
Well 4	11/29/77	<0.010	<1.00	<0.010	<0.050	0.4	<0.050	<0.002	0.3	<0.010	<0.010	--	--	--	--	--	--	--
	11/30/78	--	--	--	--	--	--	--	--	--	--	800	--	0.53	<0.050	--	60	1,550
	11/21/79	<0.010	<1.00	<0.010	<0.050	0.4	<0.020	<0.002	8.6	<0.010	<0.010	--	--	--	--	--	--	--
Well 5	11/29/77	<0.010	<1.00	<0.010	<0.050	1.0	<0.050	<0.002	0.3	<0.010	<0.010	--	--	--	--	--	--	--
	11/21/79	<0.010	<1.00	<0.010	<0.050	0.4	<0.020	<0.002	5.4	<0.010	<0.010	--	--	--	--	--	--	--
	4/20/82	<0.010	<0.50	<0.005	<0.010	0.2	<0.020	<0.001	4.5	<0.005	<0.020	394	<0.050	<0.10	<0.050	7.6	116	970
	7/07/83	<0.010	<0.20	<0.010	<0.050	0.2	<0.020	<0.001	--	<0.010	<0.010	364	<0.020	<0.10	<0.050	--	70	1,390
Well 6	11/29/77	<0.010	<1.00	<0.010	<0.050	0.6	<0.050	<0.002	0.3	<0.010	<0.010	--	--	--	--	--	--	--
	11/30/78	--	--	--	--	--	--	--	--	--	--	160	0.046	0.30	<0.050	--	54	1,460
	11/21/79	<0.010	<1.00	<0.010	<0.050	0.5	<0.020	<0.002	1.6	<0.010	<0.010	--	--	--	--	--	--	--
	4/20/82	<0.010	<0.50	<0.005	0.015	0.3	<0.020	<0.001	1.4	<0.005	<0.020	172	<0.050	<0.10	<0.050	7.8	62	430
	7/19/83	0.015	<0.20	<0.010	<0.050	0.2	<0.020	<0.001	5.6	<0.010	<0.010	--	<0.020	0.23	--	--	--	--
Apache Lake	4/20/82	<0.010	<0.50	<0.005	0.015	0.5	<0.020	<0.001	<0.2	<0.005	<0.020	166	<0.050	<0.10	<0.050	8.4	74	400
	10/82	<0.010	<1.00	<0.010	<0.050	--	<0.020	<0.002	<0.1	<0.010	<0.010	224	0.031	0.52	<0.050	--	62	652

(1) Analyses in milligrams per liter except pH which is in standard units.

Source: BES Files Williams AFB.

surface in the area. Rainfall averages about 18 inches per year (NOAA, 1977).

Drinking water for facilities at the recreation area comes from Apache Lake. The water is within primary drinking water standards that were investigated.

THREATENED AND ENDANGERED SPECIES

Williams AFB has little natural vegetation left on the 2,425 acres of unimproved land. There is negligible wildlife use of the remaining improved and semi-improved land. The lack of permanent water bodies on base prevents sustained aquatic life. The sage, mesquite and cactus on the desert provide minimal wildlife habitat. There are no special wildlife habitat areas or listed threatened or endangered plant or animal species on the base.

SUMMARY OF ENVIRONMENTAL SETTING

The environmental setting data reviewed for this investigation identified the following points that are relevant to Williams AFB:

- The soils on the base are moderately permeable which allows for good infiltration of water to the subsurface. However, net precipitation, which is rainfall minus evaporation, is -65 inches indicating that there is little potential for leachate generation at hazardous waste sites resulting from infiltrating rainfall.
- Rainfall intensity and land slope at the base indicates there is some potential for erosion and transport of surface contaminants from hazardous waste sites. The one-year, 24-hour rainfall is used to help judge erosion potential. This rainfall event at the base is 1.5 inches which is considered low to moderate in intensity. The land slope is 0.4 percent which is moderate.
- The unconsolidated alluvial deposits at and around the base are the source for ground water in the area of the base. This aquifer system consists of a deep water table aquifer that underlies the area and a shallower perched water table aquifer that underlies a part of the area including the western one-half of the base. At

Williams AFB the depth to the deep water table is approximately 400 feet. The depth to the perched water table is about 200 feet.

- Flooding potential at the base is minimal. The base lies between the 100-year and 500-year flood plain for streams in the Gila River Basin.
- Numerous wells are located on and around the base. There are four deep wells on the base. These wells are used for public supply. Wells around the base are generally used for public supply and irrigation.
- Treated water from the wastewater treatment plant on the base is used to irrigate the base golf course or is discharged to the Roosevelt Canal. The effluent from the plant meets federal and state requirements.
- The quality of ground water from wells on the base meets the primary drinking water standards for those parameters measured.
- No threatened or endangered plant or animal species exist on the base.

SECTION 4
FINDINGS

This section summarizes hazardous wastes generated by installation activities, identifies disposal sites located on base, and evaluates the potential environmental contamination. Past waste generation and disposal methods were reviewed to assess hazardous waste management at Williams Air Force Base.

REMOTE ANNEXES REVIEW

A review of file data and interviews with base employees was conducted to identify past activities at the Williams AFB Annexes that could have resulted in disposal of hazardous waste. None of the remote annexes was found to have significant waste generation or disposal activities, past or present.

Rittenhouse Auxiliary Field had two structures but no shop activities were involved. One small above ground fuel tank was provided. Aircraft received only emergency repair work. There are no known spills or leaks that have occurred on the site. Some waste oils were reportedly used periodically to control dust on Rittenhouse roads and parasail training runways. The field/survival and parasail training which Rittenhouse has been used for in the past 25-30 years is not a significant waste generation activity.

Coolidge-Florence Municipal Airport Annex has a fire protection crew and navigation personnel stationed at the facility when it is actively used by Williams AFB pilots. Any emergency aircraft repairs have been done at commercial services available at the airport. All solid wastes generated by the Air Force activities are hauled back to Williams AFB. Potable water is provided by the airport. Two aboveground fuel tanks (MOGAS and diesel) are located near the structure which houses the fire truck. No wastes have been disposed at the Coolidge Florence annex. No spills or leaks are known to have occurred.

The Waterdog Recreation Area has seepage pits which serve sinks in the cabins and a septic tank for the recreation building. Portable latrines provide sanitary service to the cabins. One inactive well which is not capped is located at the site. The adjacent lake provides the source of water for the recreation area for the past several years. All solid wastes generated are hauled by base personnel to Williams AFB. Two above-ground fuel tanks (MOGAS and diesel) are located at Waterdog; one MOGAS spill of about 25-30 gallons has occurred since the area has been in use. Most of this spill from a fuel line break evaporated on the ground. There are no known wastes disposed at the recreation area.

PAST BASE ACTIVITY REVIEW

A review was made of past and present base activities that resulted in generation and disposal of hazardous waste. Information was obtained from files and records, interviews with past and present base employees, and site inspections.

The sources of hazardous waste at Williams AFB are grouped into the following categories:

- Industrial Operations (Shops)
- Hazardous Waste Storage Areas
- Waste Oil Management
- Fuels Management
- Spills and Leaks
- Pesticide Utilization
- Fire Protection Training

The subsequent discussion addresses only those wastes generated at Williams AFB which are either hazardous or potentially hazardous. Potentially hazardous wastes are grouped with and referenced as "hazardous wastes" throughout this report. A hazardous waste, for this report, is defined by, but not limited to, the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA). For study purposes, waste petroleum products such as contaminated fuels, waste oils and waste solvents are also included in the "hazardous waste" category even though the State of Arizona does not charactrize them in

this manner. No distinction is made in this report between "hazardous substances/materials" and "hazardous wastes". A potentially hazardous waste is one which is suspected of being hazardous although insufficient data are available to fully characterize the material.

Industrial Operations (Shops)

Industrial operations at Williams AFB are grouped into five major units:

1. 82nd Air Base Group
2. 82nd Flying Training Wing/Maintenance
3. 82nd Flying Training Wing/Resource Management
4. USAF Hospital Williams
5. Tenant Units

Shop activities at Williams AFB have primarily included heavy maintenance of aircraft and ground equipment in support of pilot training schools at the base.

The base Bioenvironmental Engineering Services (BES) Industrial Facility Survey Case Files (Shop Files) and interviews were used to determine which shops handle hazardous materials and which ones generate hazardous wastes. Summary information on all base shops is provided as Appendix E, Master List of Industrial Shops.

For the shops identified as generating hazardous wastes, personnel were interviewed to determine the types and quantities of materials and present and past disposal methods. Information from base files and interviews with shop employees is summarized in Table 4.1. The waste quantities presented in this table are based either on BES file data or estimates of present quantities by shop personnel. Past disposal practices, presented as a timeline, are based on information obtained from former and current base employees. In cases where wastes were disposed of near the point of generation (electroplating and paint stripping), the past locations and years of operation are presented in Table 4.1.

A search of shop files, real property records, and interviews with base personnel have provided limited information about shop activities, hazardous waste generation rates, and disposal practices for the period from 1941 to 1949. Industrial activities increased significantly in

TABLE 4.1
INDUSTRIAL OPERATIONS (Shops)
Waste Management

SHOP NAME	CURRENT LOCATION (BLDG. NO.)	WASTE MATERIAL	CURRENT WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL 1940 1950 1960 1970 1980
82 AIR BASE GROUP				
MORALE, WELFARE AND RECREATION DIVISION				
AUTO HOBBY SHOP	491	CAUSTIC CLEANING SOLUTION	50 GALS./YR.	1954 OBCR
		WASTE ENGINE OILS & FLUIDS	100 GALS./YR.	DPDO
		WASTE SOLVENTS	40 GALS./YR.	DPDO
82 CIVIL ENGINEERING SQUADRON				
AIR CONDITIONING/REFRIGERATION	735	REFRIGERATION OIL	275 GALS./YR.	1941 FPTA 1955 DPDO
EXTERIOR ELECTRIC	735	PCB TRANSFORMERS/CAPACITORS	1-2/YR.	STORAGE/DPDO
ENTOMOLOGY/PAVEMENTS & GROUNDS/ GOLF COURSE MAINTENANCE	722, 723, 255	PESTICIDES (OUTDATED)	100 GALS./YR.(1)	PESTICIDE BURIAL SITE 1968 1972
PAINT/CORROSION CONTROL	768	LACQUER THINNER & NAPTHA	12 GALS./YR.	LANDFILL 1975 OBCR
POL MAINTENANCE	537	TANK BOTTOM SEDIMENTS	550 GALS./3-4 YRS.	WEATHERED AT FUEL STORAGE SITE OBCR 1980
POWER PRODUCTION	735	LUBRICATING OILS	1100 GALS./YR.	FPTA DPDO

KEY

——— CONFIRMED TIME-FRAME DATA BY SHOP PERSONNEL

- - - - - ESTIMATED TIME-FRAME DATA BY SHOP PERSONNEL

OBCR - OFF-BASE CONTRACT REMOVAL
DPDO - DEFENSE PROPERTY DISPOSAL OFFICE
FPTA - FIRE PROTECTION TRAINING AREA

(1) QUANTITY BURIED DURING YEARS INDICATED

TABLE 4.1 (cont'd)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	CURRENT LOCATION (BLDG. NO.)	WASTE MATERIAL	CURRENT WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL 1940 1950 1960 1970 1980
82 FLYING WING (FTW)/ MAINTENANCE				
82 FIELD MAINTENANCE SQUADRON				
PNEUDRAULICS	1080	PD-680	240 GALS./YR.	1941 FPTA 1951 DPDO
		HYDRAULIC FLUID	180-360 GALS./YR.	FPTA DPDO
ELECTROPLATING	1085(1)	CADMIUM PLATING RINSE WATER	2,600 GALS./YR.	STORM SEWER 1959 OBCR
		AMMONIUM NITRATE STRIPPER	320 GALS./YR.	1978 OBCR
		ALKALINE CLEANER BATH	960 GALS./YR.	OBCR
		ALKALINE CLEANER RINSE WATER	1,400 GALS./YR.	OBCR
		CHROMIUM PLATING RINSE WATER	2,400 GALS./YR.	STORM SEWER 1959 OBCR
		HYDROCHLORIC ACID(2)	30-60 GALS./YR.	STORM SEWER OBCR 1978
		COPPER PLATING RINSE WATER(3)	5,000 GALS./YR.	STORM SEWER
WHEEL AND TIRE	1080	PD-680	660 GALS./YR.	FPTA 1951 DPDO
		PAINT STRIPPER	120 GALS./YR.	FPTA OBCR
ELECTRIC	1084	CLEANING SOLVENT	100 GALS./YR.	OBCR 1982
		PD-680(4)	100 GALS./YR.	FPTA DPDO

KEY

——— CONFIRMED TIME-FRAME DATA BY SHOP PERSONNEL

- - - - - - ESTIMATED TIME-FRAME DATA BY SHOP PERSONNEL

OBCR - OFF-BASE CONTRACT REMOVAL
DPDO - DEFENSE PROPERTY DISPOSAL OFFICE
STORM SEWER - TO SURFACE DRAINAGE SW

(1) ELECTROPLATING SHOP LOCATED IN BLDG. T-33 (1941 to 1949)
(2) DISCONTINUED USE IN 1978
(3) DISCONTINUED USE IN 1959
(4) DISCONTINUED USE IN 1982

TABLE 4.1 (cont'd)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	CURRENT LOCATION (BLDG. NO.)	WASTE MATERIAL	CURRENT WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL 1940 1950 1960 1970 1980
82 FIELD MAINTENANCE SQUADRON (CONT'D)				
NON-DESTRUCTIVE INSPECTION (NDI)	1090	FLUORESCENT PENETRANT	110 GALS./YR.	1972 DPDO
		EMUSIFIER	110 GALS./YR.	OBCR
		ENGINE OIL	260 GALS./YR.	DPDO
CHEMICAL CLEANING	1085	SODIUM HYDROXIDE SOLUTION	1,200 GALS./YR.	1959 OBCR
		PC III	400 GALS./2 YRS.	OBCR
		ALKALINE DESCALER	800 GALS./3-4 YRS.	OBCR
		PHOSPHORIC ACID	800 GALS./3-4 YRS.	OBCR
		POTASSIUM PERMANGANATE	800 GALS./3-4 YRS.	OBCR
AEROSPACE GROUND EQUIPMENT (AGE)	24	HYDRAULIC FLUID	480 GALS./YR.	1941 FPTA 1968 DPDO
		TURBINE OIL	540 GALS./YR.	1950 FPTA DPDO
		ENGINE LUBRICANTS	130 GALS./YR.	FPTA DPDO
		PD-680	1,320 GALS./YR.	FPTA 1958 DPDO
		SULFURIC ACID	60 GALS./YR.	DILUTED TO SANITARY SEWER

KEY

——— CONFIRMED TIME-FRAME DATA BY SHOP PERSONNEL

- - - - - ESTIMATED TIME-FRAME DATA BY SHOP PERSONNEL

OBCR - OFF-BASE CONTRACT REMOVAL
DPDO - DEFENSE PROPERTY DISPOSAL OFFICE
FPTA - FIRE PROTECTION TRAINING AREA
SANITARY SEWER - TO BASE WASTEWATER TREATMENT PLANT

TABLE 4.1 (cont'd)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	CURRENT LOCATION (BLDG. NO.)	WASTE MATERIAL	CURRENT WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL 1940 1950 1960 1970 1980
82 FIELD MAINTENANCE SQUADRON (CONT'D)				
MACHINE SHOP	1080	PD-680	160 GALS./YR.	1941 FPTA 1951 DPDO
CORROSION CONTROL	25, 1086[1]	COMBINED WASTES (MEK, TOLUENE, POLYURETHANE, THINNERS, PAINT SLUDGES)	16,800 GALS./YR.	1949 STORM SEWER 1960 OBCR
ENGINE ACCESSORY REPAIR	1085	TURBINE OIL	60 GALS./YR.	1950 DPDO
		PD-680	240 GALS./YR.	FPTA DPDO
		HYDRAULIC FLUID	60 GALS./YR.	FPTA DPDO
		CALIBRATING FLUID	110 GALS./YR.	1960 DPDO
ENGINE GEARBOX REPAIR	1085	TURBINE OIL	1,040 GALS./YR.	1950 DPDO
ENGINE TEST CELL	1540	CONTAMINATED FUEL (AVGAS/JP-4)	660 GALS./YR.	FPTA 1968 DPDO
		ENGINE OIL	660 GALS./YR.	FPTA DPDO
82 ORGANIZATIONAL MAINTENANCE SQUADRON				
SUPPORT SECTION	38	HYDRAULIC FLUIDS & ENGINE OIL	6,000 GALS./YR.	FPTA 1951 DPDO
		CONTAMINATED FUEL (AVGAS/JP-4)	10,400 GALS./YR.	FPTA DPDO

KEY

——— CONFIRMED TIME-FRAME DATA BY SHOP PERSONNEL

- - - - - ESTIMATED TIME-FRAME DATA BY SHOP PERSONNEL

OBCR - OFF-BASE CONTRACT REMOVAL
DPDO - DEFENSE PROPERTY DISPOSAL OFFICE
FPTA - FIRE PROTECTION TRAINING AREA
STORM SEWER - TO SURFACE DRAINAGE NW

(1) AIRCRAFT PAINT STRIPPED IN WASHRACK 59 (1949 to 1968) OIL WATER SEPARATOR INSTALLED 1960

TABLE 4.1 (cont'd)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	CURRENT LOCATION (BLDG. NO.)	WASTE MATERIAL	CURRENT WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL 1940 1950 1960 1970 1980
82 ORGANIZATIONAL MAINTENANCE SQUADRON (CONT'D)				
AIRCRAFT INSPECTION	31, 32	HYDRAULIC FLUID	720 GALS./YR.	1941 FPTA 1951 DPDO
		ENGINE OIL	300 GALS./YR.	FPTA DPDO
		GEARBOX OIL	96 GALS./YR.	FPTA DPDO
REPAIR AND RECLAMATION	1084	HYDRAULIC FLUID	12 GALS./YR.	FPTA DPDO
82 FTW/RESOURCE MANAGEMENT				
TRANSPORTATION DIVISION				
VEHICLE MAINTENANCE SHOPS	533	CONTAMINATED FUEL (AVGAS/JP-4)	600 GALS./YR.	FPTA 1968 DPDO
		HYDRAULIC FLUID	24 GALS./YR.	FPTA DPDO
		AUTOMATIC TRANSMISSION FLUID	60 GALS./YR.	1950 FPTA DPDO
		MOTOR OIL	1,380 GALS./YR.	FPTA DPDO
		BRAKE FLUID	12 GALS./YR.	FPTA DPDO
		PD-680	12 GALS./YR.	FPTA DPDO
		PAINT STRIPPER	165 GALS./YR.	FPTA OBCR

KEY

——— CONFIRMED TIME-FRAME DATA BY SHOP PERSONNEL

- - - - - - ESTIMATED TIME-FRAME DATA BY SHOP PERSONNEL

OBCR - OFF-BASE CONTRACT REMOVAL
DPDO - DEFENSE PROPERTY DISPOSAL OFFICE
FPTA - FIRE PROTECTIONTRAINING AREA

TABLE 4.1 (cont'd)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	CURRENT LOCATION (BLDG. NO.)	WASTE MATERIAL	CURRENT WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL 1940 1950 1960 1970 1980
SUPPLY DIVISION				
MUNITIONS	1124	CASING AND PROPELLANT INCINERATOR ASH	20 CU. FT./YR.	1979 DPDO
FUELS MANAGEMENT LAB	547	CONTAMINATED FUEL (AVGAS/JP-4)	600 GALS./YR. (1)	1941 FPTA OR DPDO
425 TACTICAL FIGHTER TRAINING SQUADRON				
AIRCRAFT GENERATION BRANCH	75	HYDRAULIC FLUID, ENGINE OIL, & CONTAMINATED FUEL (AVGAS/JP-4)	850 GALS./YR.	1941 FPTA 1965 DPDO
COMPONENT REPAIR BRANCH	46	HYDRAULIC FLUID	600 GALS./YR.	FPTA DPDO
		CONTAMINATED FUEL (AVGAS/JP-4)	1,800 GALS./YR.	FPTA DPDO
SUPPORT BRANCH	75	HYDRAULIC FLUID & WASTE OIL	600 GALS./YR.	FPTA DPDO
DETACHMENT 17, 24-WEATHER SQUADRON				
WEATHER EQUIPMENT MAINTENANCE	19	ELECTROSTATIC DISPERSANT SOLVENT	6 GALS./YR.	FPTA 1983 OBCR

KEY

——— CONFIRMED TIME-FRAME DATA BY SHOP PERSONNEL

- - - - - - ESTIMATED TIME-FRAME DATA BY SHOP PERSONNEL

DPDO - DPDO DEFENSE PROPERTY DISPOSAL OFFICE
FPTA - FIRE PROTECTION TRAINING AREA
OBCR - OFF BASE CONTRACT REMOVAL

(1) THIS IS CURRENT QUANTITY TESTED; QUANTITY TO WASTE IS VARIABLE.

1949 when heavy maintenance of jet powered aircraft was started. For the period from 1941 to 1959, the major industrial shops for aircraft maintenance were located in buildings and structures along the west side of Taxiway No. 1. The sheet metal, welding, machine, hydraulic, electric and brake repair shops were located in Building 33, which was torn down in 1968. The engine repair shops were located in Building 32. Chromium, cadmium, and copper electroplating operations were conducted in a temporary building, T-31. Paint stripping was conducted at Washrack No. 59. Airplanes were painted in the corrosion control shop in Building 25.

The major aircraft repair shops were moved to their present locations during the period from 1959 to 1968. The jet engine repair shops, the chemical cleaning shop, and the electroplating shop are currently located in Building 1085, which was constructed in 1959. Building 1080, which contains the pneudraulics, machine and wheel and tire shops, was constructed in 1968. Other facilities and buildings, in which aircraft maintenance and repair activities are conducted, have been constructed since 1968. The current test cells and trim pad were constructed in 1971. The test cells had been formerly located on the southwest side of Taxiway No. 2. The Non-Destructive Inspection Building was constructed in 1972. According to current shop personnel the NDI/SOAP Laboratories did not exist on the base before 1972. The building that houses the fuel cell shop, Building 1092, was constructed in 1974. The fuel cell shop personnel had formerly operated outdoors in the area where the building was constructed.

The 425th Tactical Fighter Training Squadron (425 TFTS) has been a tenant at Williams AFB since the early 1940's. During the 1960's, the 425th performed heavy maintenance and repairs of aircraft in Hangers 37 and 38. The squadron operated engine repair shops in Building 32. They currently operate only shops that perform light maintenance on F-5 fighters in Buildings 46 and 75.

The 82nd Field Maintenance Squadron (82 FMS) currently operates the shops which perform heavy maintenance on the T-37, T-38, and F-5 aircraft at Williams AFB. The 82nd Organizational Maintenance Squadron (82 OMS) performs inspection and light maintenance on these aircraft in Buildings 31 and 32.

The 24th Weather Maintenance Squadron currently generates 6-gallons per year of electrostatic dispersant solvent. Use of the solvent was initiated in 1983. The solvent was originally disposed of by burning in fire protection training exercises; however, it is currently taken to a hazardous waste accumulation point by shop personnel and disposed of by an EPA licensed hazardous waste contractor.

The wastes generated in shops at Williams AFB consist mainly of contaminated jet fuel (JP-4), waste oils and lubricants, acid and alkaline cleaning solutions, electroplating rinsewaters, solvents, paint strippers, and paint sludges.

The waste petroleum products are currently sold through the Defense Property Disposal Office (DPDO) at Luke AFB to an off-base contractor for reprocessing. These wastes have been sold to off-base contractors for many years, probably since 1950 when the first of nine underground waste oil storage tanks was installed. The installation of the first waste oil storage tank coincides with the increase in shop activity and waste generation that occurred, due to the start of heavy maintenance of jet powered aircraft. Prior to 1968 waste petroleum products that were not shipped off base were collected in drums and burned during fire protection training exercises.

The rinsewater from electroplating operations is currently disposed of by an off-base contractor. As previously discussed, the first electroplating shop at Williams AFB was located in a temporary building. The building was approximately 18 feet wide by 30 feet long with a concrete floor. The buildings contained plating solutions and rinse tanks. The rinse tanks were equipped with spray faucets for part rinsing. The overflow drained to the base storm sewer system. No information is available on the disposition of spent plating solutions; however, the volume of plating solutions disposed of was small since the solutions were rarely changed. The empty tanks were disposed of in the base landfill prior to or at the time of relocation of the plating shop to Building 1085. After relocation, the plating solutions were disposed of by an off-base contractor, who also disposed of the waste cleaning solutions from the chemical cleaning shop. Base employees have indicated that electroplating rinsewaters were also shipped off base. Since 1978 when Building 1085 was expanded, some electroplating operations

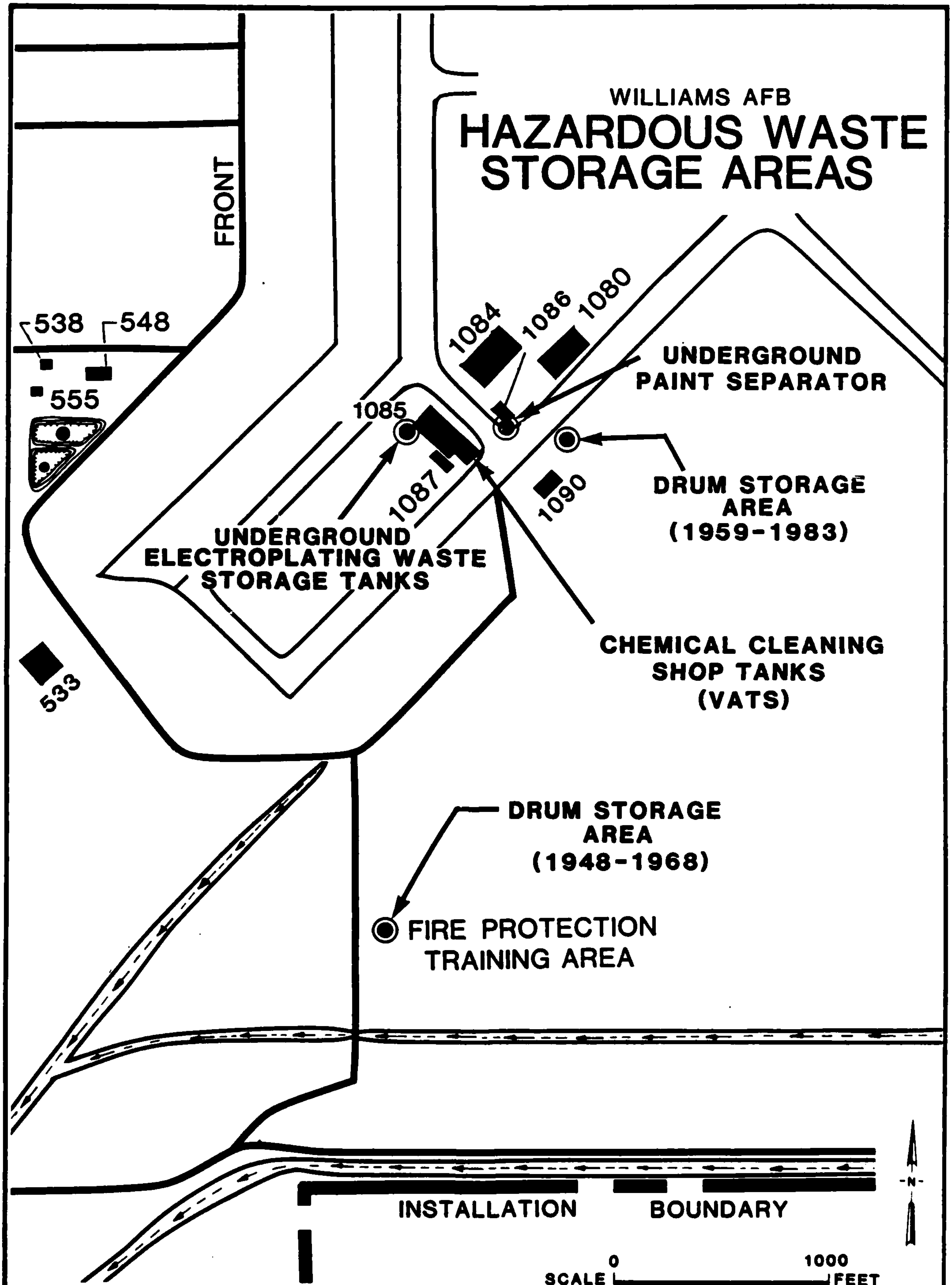
added, and two underground hazardous waste storage tanks were constructed, all electroplating wastes have been disposed of by an off-base contractor.

Aircraft cleaning and paint stripping operations were conducted at washrack 59 during the period from 1949 to 1968, with an oil-water separator installed about 1960. The solvent (PD-680) used for aircraft washing, paint strippers, and stripped paint were washed to drains that connect to the storm sewer system. Stripping and painting operations have been conducted in the corrosion control shop in Building 1086 since 1968 with the wastes washed to an underground storage tank. The hazardous wastes are separated from water in the tank and the water is pumped to the sanitary sewer system. The hazardous wastes are pumped into a tanker truck and disposed of by an off-base contractor.

Hazardous Waste Storage Areas

The base has three hazardous waste accumulation points: 1) underground tanks near the electroplating shop in Building 1085, 2) an underground paint separator next to the corrosion control shop, and 3) the process tanks in the chemical cleaning shop in Building 1085. The locations of these facilities are shown in Figure 4.1. One of the tanks near the electroplating shop receives wastes from cadmium plating operations. The other tank receives chromium plating wastes. The paint separator receives wastes from paint stripping operations that are performed in Buildings 25 and 1086. It also receives waste emulsifier from the NDI/SOAP Laboratories and small quantities of compatible hazardous wastes from the weather, maintenance and electric shops. The contents of the electroplating tanks and paint separator tank are removed from the tanks every 60 days, by a contract carrier that is licensed by the U.S. EPA, and taken to an approved treatment, storage or disposal (TSD) facility. The chemical cleaning tanks in Building 1085 are pumped when the process solutions are spent by the same contract carrier.

There are presently no drum storage areas for hazardous wastes at Williams AFB. There are no records of the existence of drummed storage areas on the base, however interviews with base personnel revealed that waste oils, solvents, JP-4 and other combustible materials were stored near Fire Protection Training Area No. 2 near the south side of the



SOURCE: WILLIAMS AFB INSTALLATION DOCUMENTS

base. These wastes were taken in drums to the area by shop personnel. The maximum number of full drums in storage at FPTA No. 2 was estimated at approximately 50 by present and past base employees.

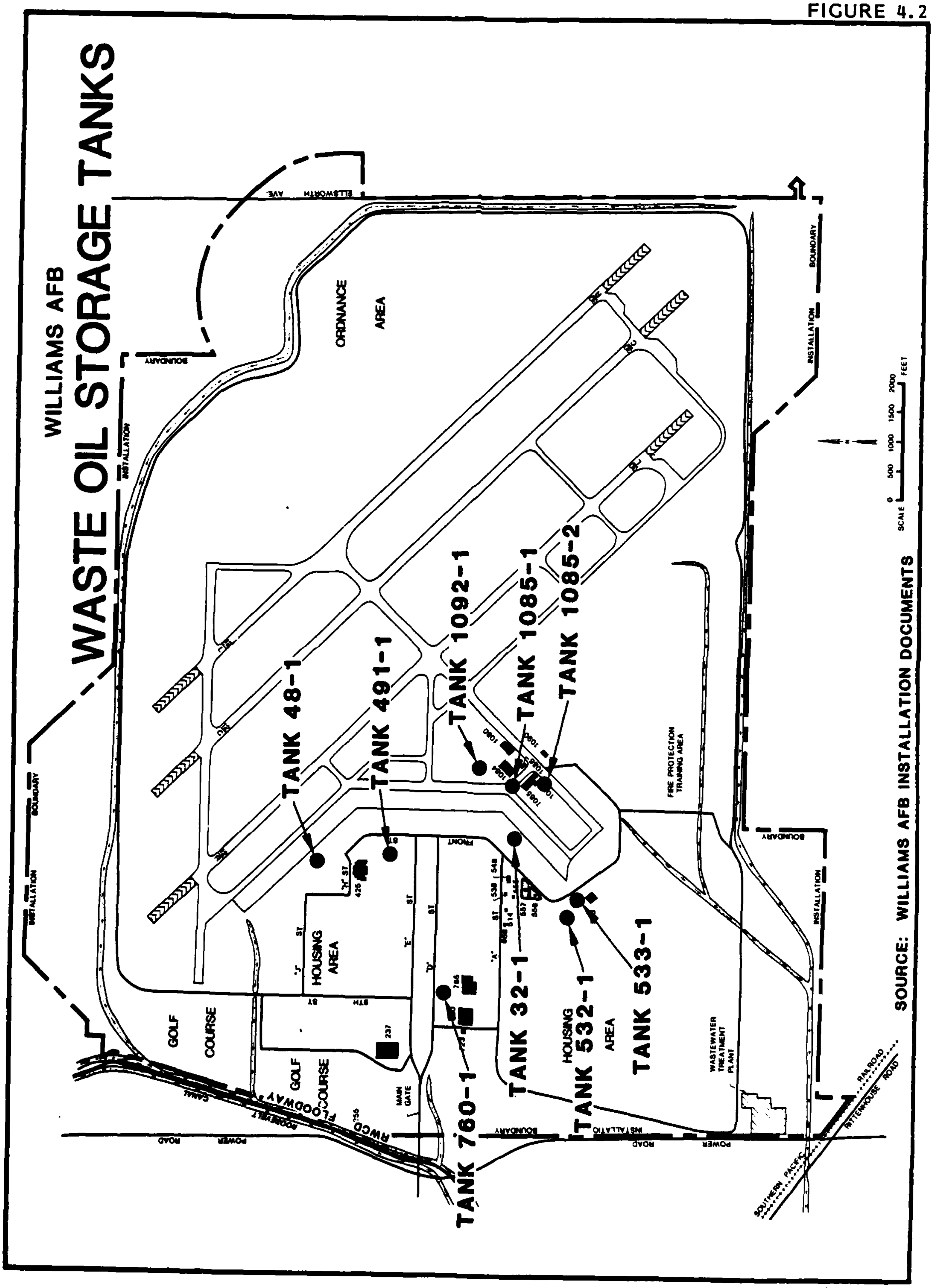
There is evidence that a hazardous materials storage area, located across Taxiway No. 6 from Building 1080, was used for storage of hazardous wastes. The storage area was approximately 30 feet by 40 feet, which was estimated based on the area that is covered with fine gravel. The area may have been used to store hazardous wastes from the corrosion control shop in Building 25 until the wastes could be placed in the holding tank near Building 1086. In 1981, five 55-gallon drums of waste alkaline solution were found in the area. The drums were removed from the area by an EPA licensed hazardous waste contractor. This hazardous material storage area (see Figure 4.1) was abandoned in 1983 and replaced by a new facility. The new facility is not used for the storage of hazardous wastes.

Waste Oil Management

The locations of the underground waste oil storage tanks are shown in Figure 4.2. These tanks are used for holding contaminated JP-4, waste oils, solvents and hydraulic fluid. After 1950, waste oil storage tanks were installed at the same time that buildings housing significant waste oil generating shops were constructed. Other shops that generate lesser quantities of waste petroleum products transport their wastes to the tanks in 5-gallon to 55-gallon containers. During aircraft defueling, JP-4 is pumped from the airplanes. The residual fuel which cannot be pumped is drained into bowsers which are emptied into the waste oil storage tanks. The wastes are pumped out of the storage tanks each month by a DPDO contractor who processes them and reclaims the oil.

Information about the ages of the tanks, materials stored in the tanks, tank capacities, and average monthly accumulations is presented in Table 4.2. All of the storage tanks are constructed of steel. The information in Table 4.2 was compiled from an Air Force report that was prepared in 1979. The tanks are tested regularly for leaks by checking the level of fluid in the tank over a 24 hour period, during which no oil is added or withdrawn. There is no evidence of past or present leakage from the tanks.

FIGURE 4.2



WILLIAMS AFB
WASTE OIL STORAGE TANKS
TANK 48-1
TANK 491-1
TANK 1092-1
TANK 1085-1
TANK 1085-2
TANK 32-1
TANK 532-1
TANK 533-1
TANK 760-1
ORDNANCE AREA
HOUSING AREA
GOLF COURSE
FIRE PROTECTION TRAINING AREA
WASTEWATER TREATMENT PLANT
MAIN GATE
ELLSWORTH AVE.
POWER ROAD
INSTALLATION BOUNDARY
RWCD FLOODWAY
ROOSEVELT CANAL
SOUTHERN PACIFIC RAILROAD
RITTENHOUSE ROAD
FRONT ST
SCALE 0 500 1000 1500 2000 FEET
SOURCE: WILLIAMS AFB INSTALLATION DOCUMENTS

TABLE 4.2

UNDERGROUND WASTE OIL STORAGE TANKS

Location (Bldg. No.)	Year Building Constructed	Tank ID No.	Year Tank Installed	Material in Storage	Capacity (gallons)	Average Monthly Accumulation (gallons)
32	1942	32-1	1950	Oil & JP-4	1,000	700
491	1954	491-1	1954	Oil	250	---
760	1955	760-1	1955	Oil	200	150
1352, 1353	1961	48-1	1961	Oil & JP-4	1,000	250
532	1967	532-1	1967	Oil & JP-4	500	250
533	1969	533-1	1969	Oil & Hyd. Fluid	1,000	250
1085	1959	1085-2	1959	Oil & JP-4	500	70
1085	1959	1085-1	1972	Oil & Solvents	280	70
1092	1974	1092-1	1974	Oil & JP-4	500	100

Source: Williams AFB File Data

Fuels Management

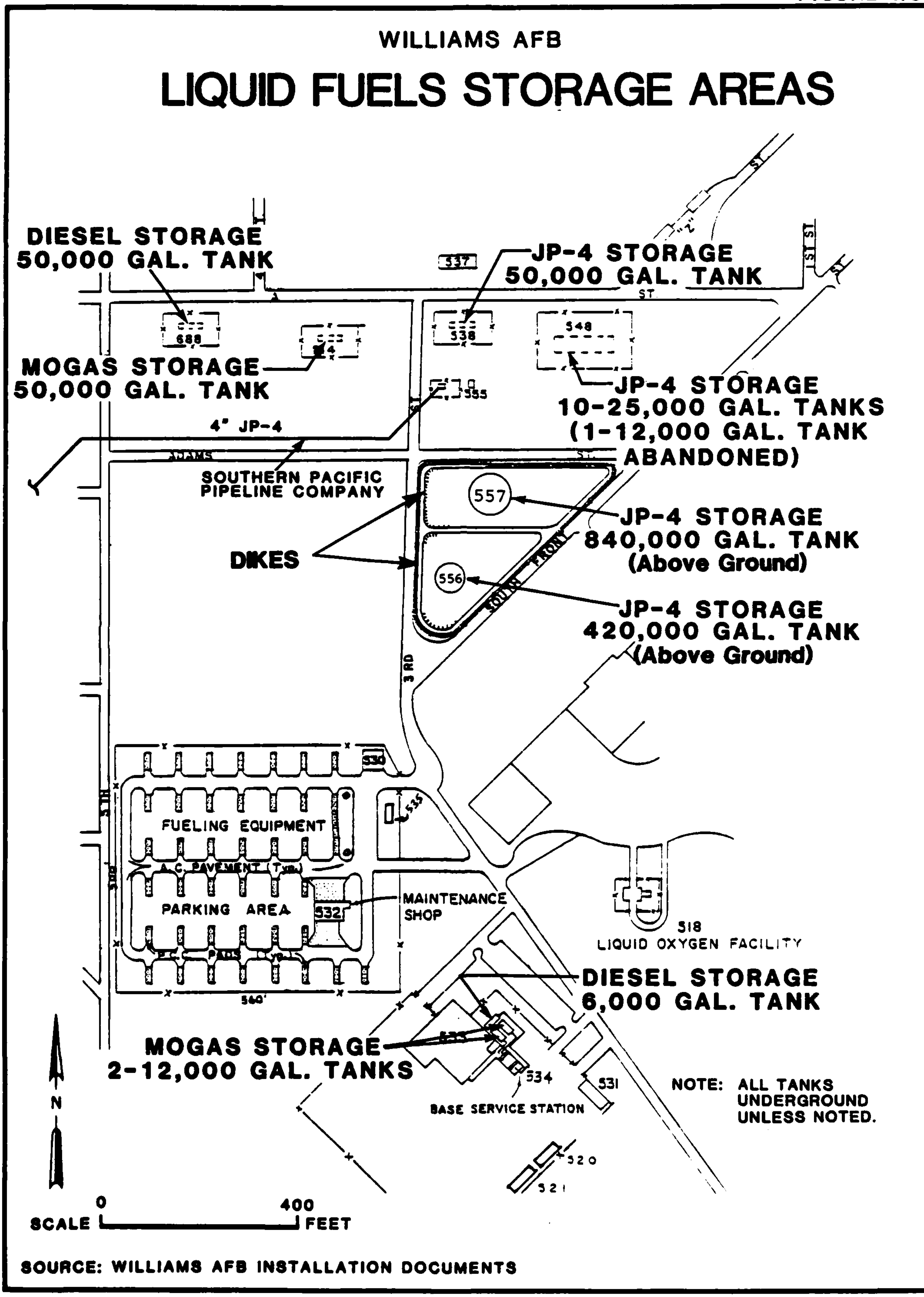
The liquid fuels storage system at Williams AFB consists of above and below ground storage tanks. A summary of the fuel storage tanks is presented in Appendix D. Fuels in storage include: JP-4, MOGAS, and diesel fuel. Jet engine fuel (JP-4) is usually conveyed to the base through a pipeline (Southern Pacific Pipeline), however, the fuel can be delivered to the base in tanker trucks. Diesel fuel and MOGAS are trucked onto the base.

Locations of the major fuel storage tanks are shown in Figure 4.3. The underground storage tanks (Facilities 548, 538, 514, and 688) were constructed in 1942. Tanks 556 and 557 were constructed in 1962 and 1954, respectively. Cathodic protection was installed on the tanks in 1970.

The Number 11 tank of Facility 548 was taken out of service and filled with sand in approximately 1960. Initially Tanks 13 and 14 were used to store aircraft fuels. In 1977, Tank No. 14 (Facility 688) was converted to a diesel fuel storage tank. Tank No. 13 (Facility 514) was taken out of service in 1979. This tank was filled (50,000 gallons) with a 5 percent caustic solution, which was pumped out onto the ground a few months later when it was decided to use the tank for MOGAS storage.

The liquid fuel storage tanks are cleaned when the solids in the tanks reach a specified level. Currently the sludges from tank bottoms are drummed and disposed of by a contractor off base. Prior to 1979 the material was weathered (i.e., air dried in drums) and then scattered on the ground at various locations within the area of the fuel storage tanks.

The underground fuel tanks are pressure tested annually for leaks. The underground JP-4 tanks were visually inspected in 1979. The tanks were found to be pitted, but not leaking. The above ground tanks are visually inspected daily. There are no records of leakage from the underground or above ground tanks. However, there have been leaks and spills related to fuel system equipment failures. These spills and leaks are discussed further in the following section.


WILLIAMS AFB
LIQUID FUELS STORAGE AREAS
DIESEL STORAGE
50,000 GAL. TANK
JP-4 STORAGE
50,000 GAL. TANK
537
ST
548
688
538
MOGAS STORAGE
50,000 GAL. TANK
555
JP-4 STORAGE
10-25,000 GAL. TANKS
(1-12,000 GAL. TANK
ABANDONED)
4" JP-4
ADAMS
SOUTHERN PACIFIC
PIPELINE COMPANY
557
JP-4 STORAGE
840,000 GAL. TANK
(Above Ground)
DIKES
556
SOUTH FRONT
JP-4 STORAGE
420,000 GAL. TANK
(Above Ground)
3 RD
530
535
FUELING EQUIPMENT
A.C. PAVEMENT (Typ.)
PARKING AREA
532
MAINTENANCE
SHOP
518
LIQUID OXYGEN FACILITY
560'
DIESEL STORAGE
6,000 GAL. TANK
MOGAS STORAGE
2-12,000 GAL. TANKS
533
534
531
BASE SERVICE STATION
NOTE: ALL TANKS
UNDERGROUND
UNLESS NOTED.
N
520
521
0
400
SCALE
FEET
SOURCE: WILLIAMS AFB INSTALLATION DOCUMENTS

Spills and Leaks

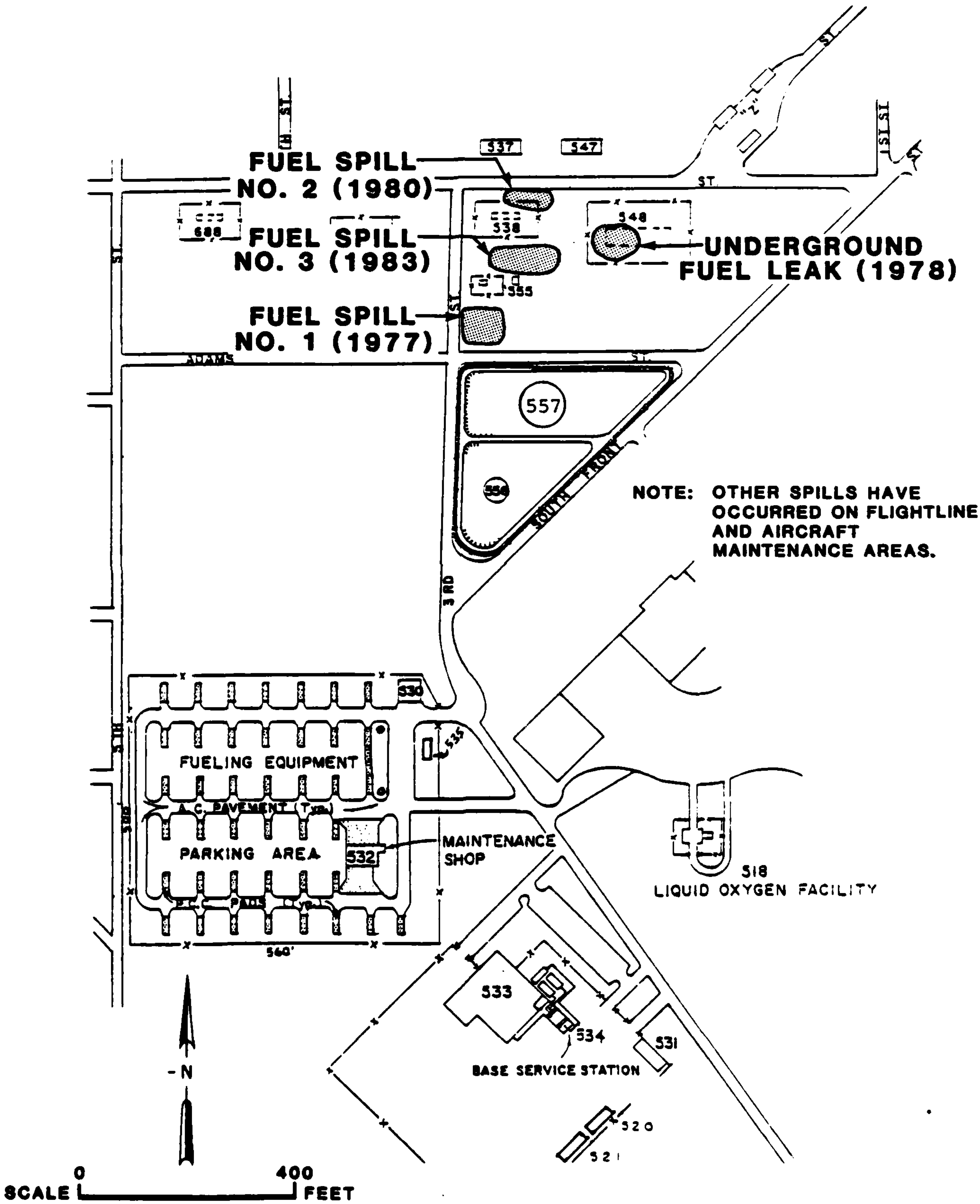
The majority of spills which have occurred at Williams AFB have involved small quantities of fuels, oils, and hydraulic fluid. Oil and hydraulic fluid spills have occurred on the flightline and in the aircraft maintenance/hanger shops. Fuel spills have occurred mainly on the flightline during aircraft fueling and defueling. Five to ten spills per year in the flightline/maintenance area are considered typical by fire department employees. Spills in the hangers have generally been small (involving an area less than 50 square feet and under 10 feet in any dimension) according to fire department personnel. Larger spills are more typical on the flightline. The largest spill that is known to have occurred on the flightline was the result of a fuel hose coming loose from an aircraft. Approximately 300 gallons of JP-4 was spilled and hosed to a storm drain. All flightline spills drain to the base storm sewer system while maintenance shop spills will usually enter a sanitary sewer.

Fuel spills and leaks have occurred in the liquid fuel storage area. The locations of these spills/leaks are shown in Figure 4.4. Three fuel spills are known to have occurred in the liquid fuel-storage area. One of these spills occurred in 1977 when the strainer on the Southern Pacific Pipeline Company's facility malfunctioned. The malfunction occurred during the night and was not discovered until the following morning. Approximately 2,000 to 4,000 gallons spilled on the ground south of Facility 555. In 1980, approximately 800 to 1,000 gallons was spilled north of Facility 538. A third fuel spill of approximately 1,000 gallons occurred between Facilities 538 and 555 in 1983. The first and third fuel spills were foamed and allowed to percolate into the ground. The second spill was washed into a ditch and allowed to percolate into the ground.

A leak occurred at Facility 548 in 1978. Six of the underground fuel lines connecting the underground fuel tanks to above ground fuel tanks were replaced when JP-4 was observed seeping into a sump. The exact quantity of fuel that leaked cannot be estimated, however, base employees who were involved in the replacement of the pipes indicated that the excavated ground was not saturated with fuel.

WILLIAMS AFB

MAJOR SPILL AREAS



SOURCE: WILLIAMS AFB INSTALLATION DOCUMENTS

Electrical power transformers, containing polychlorinated biphenyls' (PCB's), have been used and are currently in service at Williams AFB. There are no records of any occurrence of major spills in transformer storage areas. Prior to 1979, transformers that had been taken out of service were stored at Facility 8002, an outside storage area. Transformers, oils, and drummed soils known or suspected of being contaminated by PCB's are presently stored in Building 766, which was specifically constructed for this purpose on a monolithic slab without floor drains. Contaminated transformers and materials are disposed of through the DPDO at Luke AFB. Presently all oil spills from electrical equipment are treated as PCB spills, until laboratory tests prove that PCB's are not present. Contamination or migration from past electric transformer spills or handling of contaminated transformers at Williams AFB are not considered to be a problem.

Pesticide Utilization

A variety of pesticides have been used at Williams AFB for control of weeds, insects, and rodents. These pesticides have been used primarily by entomology, pavings and grounds, and golf course maintenance activities. Since 1972, the application of pesticides has been performed by contractors and monitored by Air Force personnel. A list of pesticides that are used at the base is presented Appendix D.

The pesticides applied at the golf course are mixed and placed in sprayers in a fenced area at Building 255. The empty containers are triple rinsed. Water that is used to rinse the containers is drained to the ground in the vicinity of Building 255.

Pesticides used at other areas of the base are stored and mixed in Buildings 722 and 723. Water used to triple rinse the containers is collected, placed in sprayers and sprayed at various sites as a part of the normal application procedures. There are currently approximately 300 gallons of expired pesticides that have accumulated since about 1972. These pesticides were stored in Building 722 until 1983 and then moved to Building 1010.

Empty pesticide containers are punctured and placed in trash dumpsters. Prior to 1976 the containers were disposed of at the base landfill. Since the closing of the landfill these containers have been disposed of off base.

Fire Protection Training

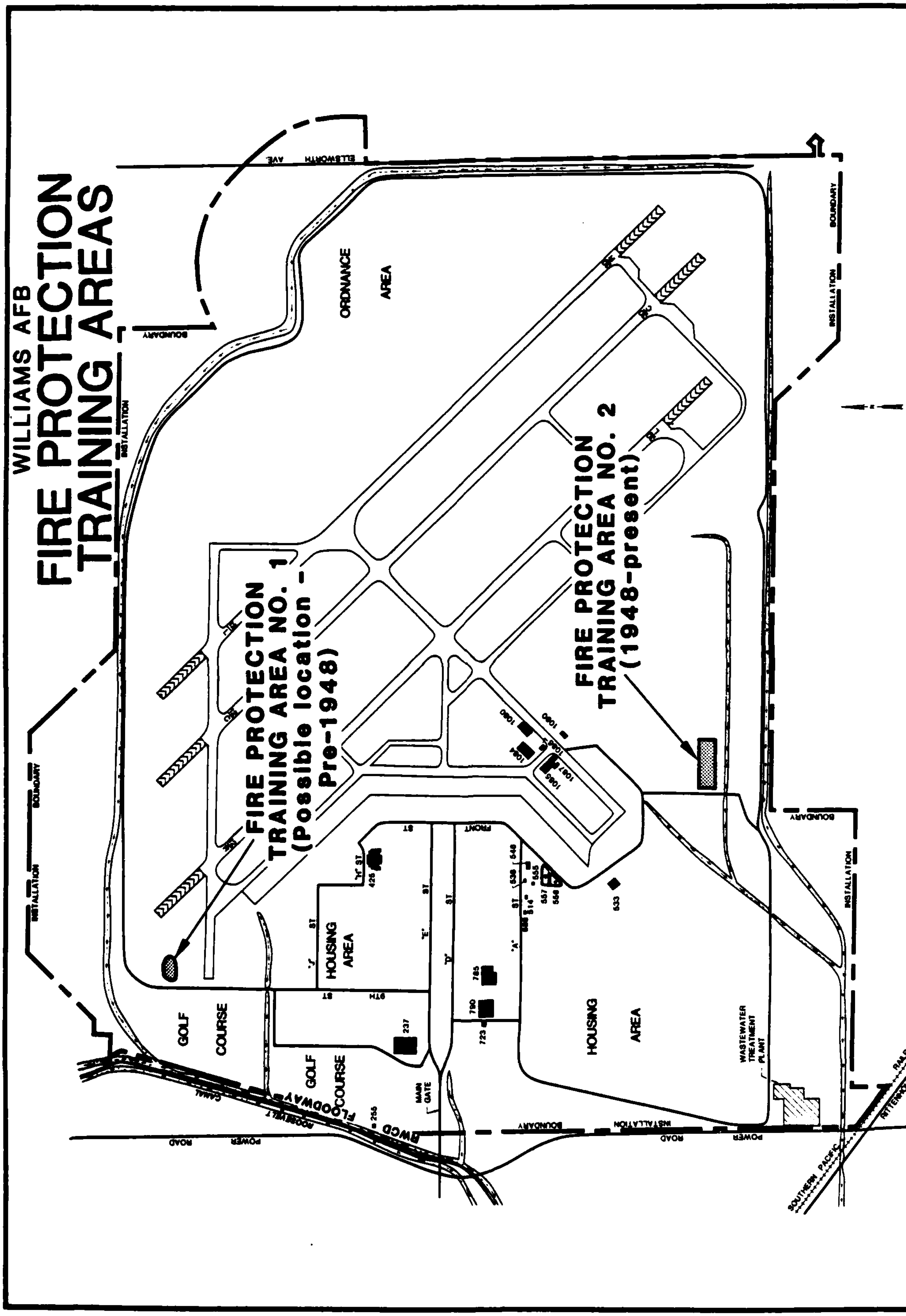
There are two known areas where fire protection training activities have been conducted on the base (Figure 4.5). The initial fire protection training area (FPTA) is believed to be located between the runway and the northern part of the golf course. The location is approximate since there is no surface evidence of past fire training exercises in the area. Fire Protection Training Area No. 1 ceased operations in 1948 and it is assumed that it started in the early 1940's. Fuels, waste oils and other combustibles were burned after water was placed on the burn site. All residual unburned materials and fire extinguishing agents percolated to the ground. The number of fires ignited in the 1940's is believed to have been lower than in later years when training activities received more emphasis.

The existing fire protection training area (FPTA-No. 2) burned waste solvents, hydraulic fluids, oils, and aircraft fuel from 1948 until approximately 1968. After 1968 clean JP-4 and some contaminated JP-4 has been burned at the site. The amount of wastes burned generally declined from the 1950's until 1968.

Until the mid 1970's two to three fires were ignited per week. In more recent years approximately eight to twelve fires per quarter has been typical.

In the 1950's and 1960's up to 1,000 gallons of combustibles were often used per fire. This quantity per fire dropped to about 600 gallons in the 1970's and then to 300 gallons in the 1980's. Extinguishing agents used until the early 1970's were protein foam and chlorobromomethane. In more recent years aqueous film forming foam (AFFF), halon and dry chemicals have been employed.

The area used for training has consisted of shallow pits on the ground where the waste material or clean fuel was placed immediately before combustion. The ground surface has always been wetted prior to putting the combustion materials in the pits. In 1983 the two burn pits were reconstructed to include a shallow gravel layer on a concrete slab (see Appendix F for photographs). Any residual unburned fuel and/or extinguishing agent drains through pipes to a holding tank. Residual materials prior to 1983 soaked to the ground, volatilized, or drained to the holding tank.



SOURCE: WILLIAMS AFB INSTALLATION DOCUMENTS

BASE TREATMENT AND DISPOSAL METHODS

The facilities at Williams AFB which have been used for management and disposal of waste are as follows:

- o Landfill
- o Waste Pesticide Burial Site
- o Radioactive Waste Burial Site
- o Hardfill Areas
- o Sanitary Sewerage System
- o Sludge Disposal Areas
- o Incinerators
- o Surface Drainage System

Landfill

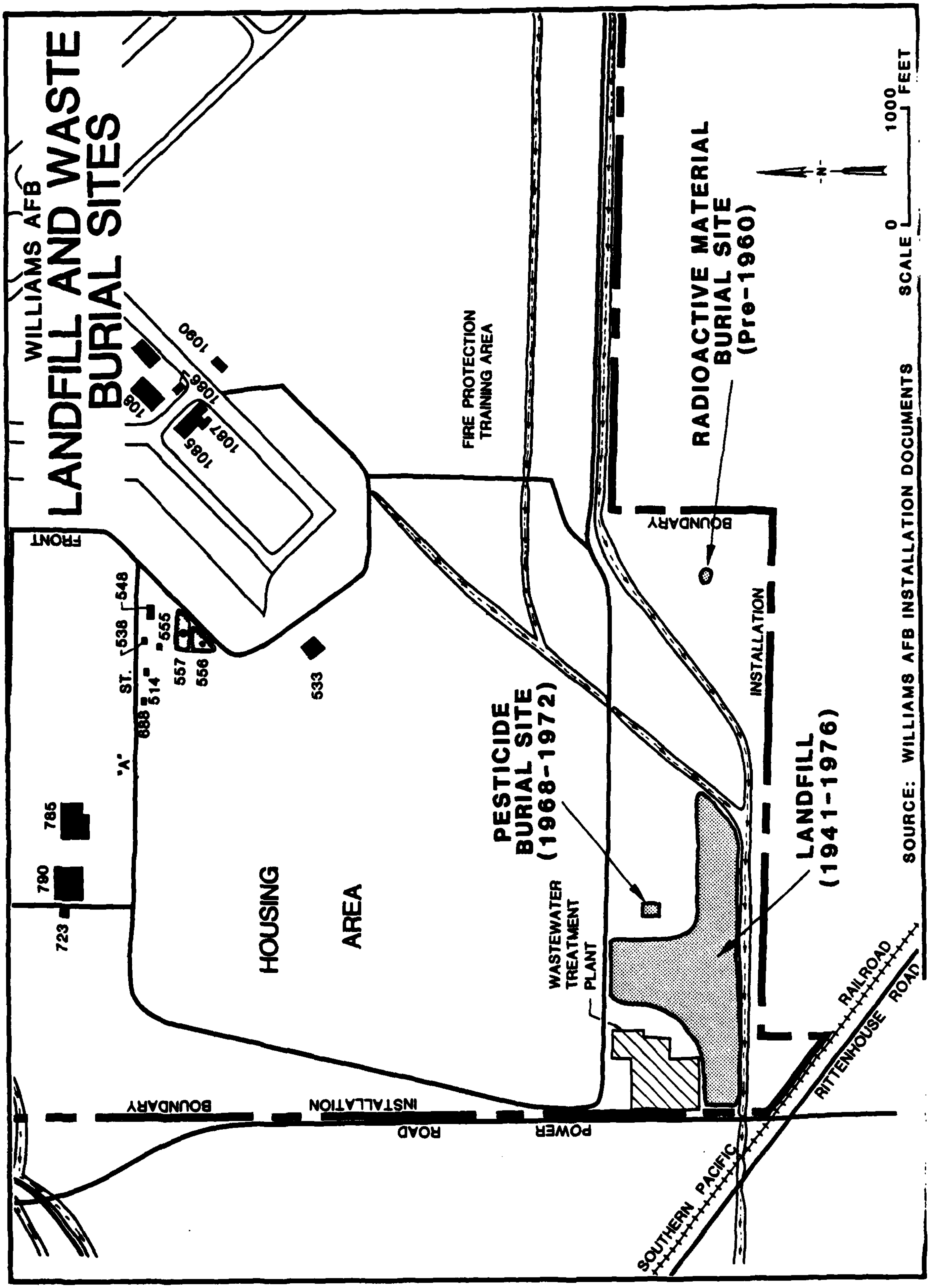
Only one landfill, located in the southwest corner of the base (Figure 4.6), has been operated since the base was constructed. Since 1976 when the landfill was closed, all wastes have been hauled off-base for disposal by a contractor.

The landfill received garbage, paper, wood, metal, brush, waste paint and thinner cans, oil and solvent cans and rags, unrinsed pesticide containers, adhesive containers, and electronic parts. A combination trench and area fill method of operation was used at the site. Trenches were dug 15-20 feet deep and then filling continued to a level approximately 10-15 feet above the original ground level, for a total fill depth of 25-35 feet.

The area of the landfill site is approximately 34 acres. Filling first started in the southwest corner of the site (Figure 4.6). It then progressed to the area east of the wastewater treatment plant, followed by filling in the southeast corner of the site. During the 1940's and 1950's material deposited at the landfill was routinely burned.

The landfill site is adjacent to the major drainage channel (normally dry) which runs along the southern installation boundary. Drainage from the site reaches this channel during runoff events. Some vegetation has re-established on the site since closure. The top surface of the landfill is irregular from differential trench settlement

FIGURE 4.6



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and will serve to pond water during heavy rainfall periods. A minor amount of unburied waste (brush, metal, wood) has accumulated on the site since closure.

Appendix F contains photographs of the landfill site. Table 4.3 summarizes the landfill operation.

Pesticide Burial Site

The pesticide burial site, located adjacent to the landfill, received containers of outdated pesticides during the period 1968-72. The location of the site is shown in Figure 4.6 and photographs are presented in Appendix F. Table 4.3 summarizes available data on the burial site. It is reported that on 4 or 5 occasions during this period, partially filled pesticide containers were buried in separate excavations at the site. One typical burial included five to ten 10-gallon containers and two 55-gallon drums. No information is available concerning the type of pesticides disposed at the site.

Radioactive Material Burial Site

The radioactive material burial site is located east of the landfill site near the installation boundary (Figure 4.6). Until the period 1958-59 it was common practice for the Air Force to bury radioactive wastes. The site at Williams AFB has reportedly been posted as a radioactive burial site at least back to the early 1960's and possibly earlier. It is believed that low-level radioactive wastes (such as radium dials, electron tubes, etc.) were put in a drilled hole such as would be constructed for a well. A fence, sign and concrete cap protruding above grade exist at the burial site. However, no information was available in the files or through interviews which would confirm waste type and quantity, years waste was buried, or burial procedures and configurations. According to Tab A-1 file data, the surface radioactivity count is normal.

Hardfill Areas

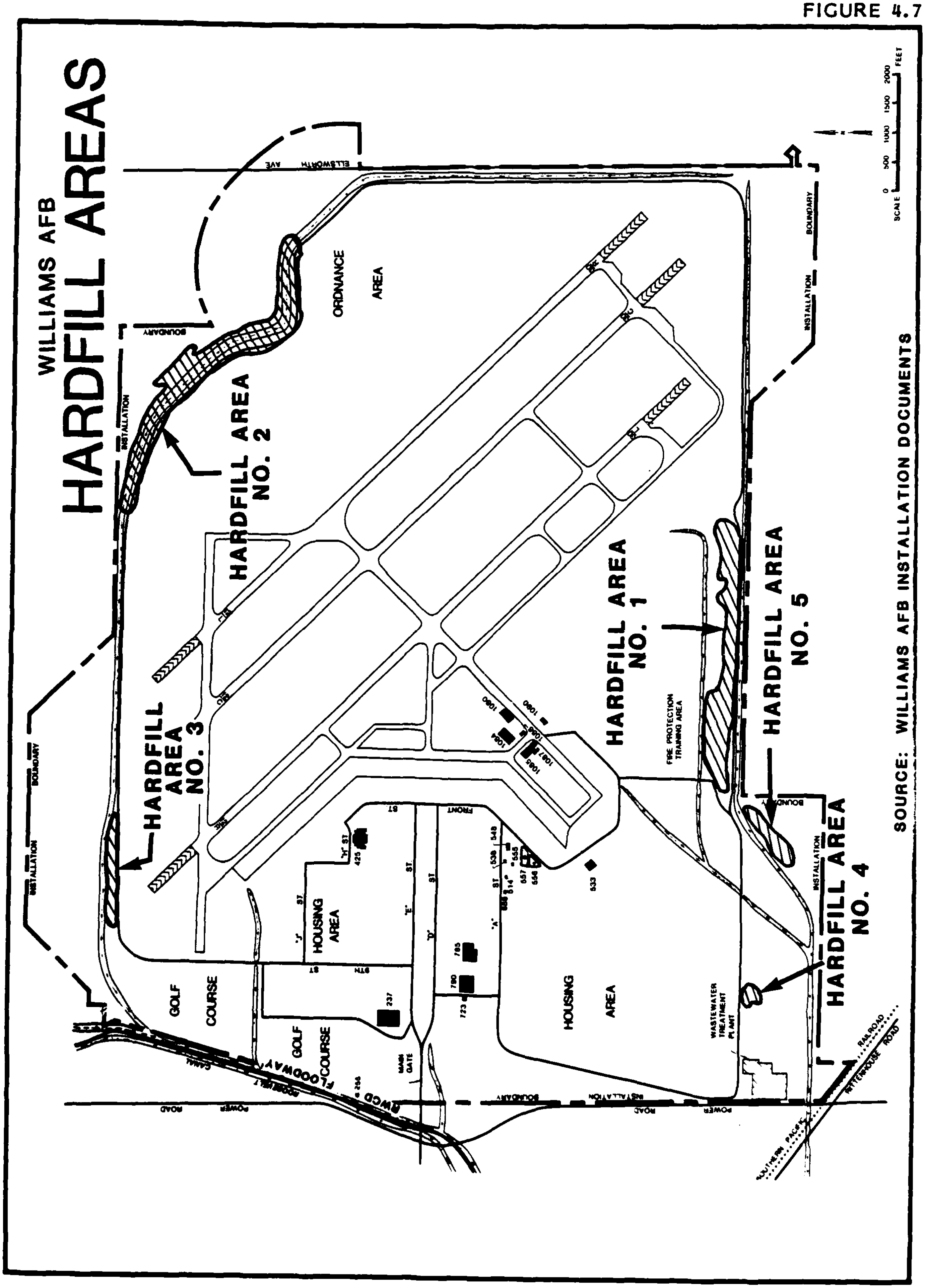
Five hardfill areas have been identified at Williams AFB as illustrated in Figure 4.7 and Appendix F photographs. The areas in Figure 4.7 are numbered for identification purposes only since there has been no specific sequence of filling each area. The areas were generally filled depending upon the proximity to where the waste material originated. Table 4.3 summarizes the hardfill disposal areas.

TABLE 4.3
SUMMARY OF LANDFILL SITE, HARDFILL AREAS, PESTICIDE BURIAL SITE, AND RADIOACTIVE MATERIAL BURIAL SITES

Site	Period of Operation	Approximate Area (Acres)	Type of Wastes	Method of Operation	Comments
Landfill	1941-1976	34	Garbage, refuse, some shop wastes.	Trench and area fill; 15-20 ft below grade to 10-15 ft above grade; burning.	Site closed and covered but some material dumped on top of site and not covered since closure.
Hardfill Areas					
No. 1	1958-1978	32	Concrete, asphalt, structural steel, wire, wood, adhesive containers.	Placed at grade.	Waste not covered.
No. 2	1958-1978	13	Concrete, brush, tires, wood.	Placed at grade.	Waste not covered.
No. 3	1958-1978	0.8	Concrete, brush, adhesive containers.	Placed at grade.	Waste not covered.
No. 4	1958-1978	0.9	Asphaltic concrete.	Placed at grade.	Waste not covered.
No. 5	1958-1978	9	Asphaltic concrete.	Placed at grade.	Waste not covered.
Pesticide Burial Site	1968-1972	0.1	Outdated pesticides.	Hole dug and material buried.	Type pesticides unknown.
Radioactive Material Burial Site	Pre - 1960	<0.1	Presumed low level radioactive materials.	Presumed vertical core drilled and capped.	Type, quantity and date unknown.

Source: Interviews and file data.

FIGURE 4.7


WILLIAMS AFB
HARDFILL AREAS
HARDFILL AREA NO. 1
HARDFILL AREA NO. 2
HARDFILL AREA NO. 3
HARDFILL AREA NO. 4
HARDFILL AREA NO. 5
ORDNANCE AREA
HOUSING AREA
HOUSING AREA
GOLF COURSE
GOLF COURSE
FIRE PROTECTION TRAINING AREA
WASTEWATER TREATMENT PLANT
ELLSWORTH AVE
POWER ROAD
INSTALLATION BOUNDARY
RWCD FLOODWAY
CANAL
MAIN GATE
FRONT ST
SOUTHERN PACIFIC RAILROAD
RITTENHOUSE ROAD
SCALE 0 500 1000 1500 2000 FEET
SOURCE: WILLIAMS AFB INSTALLATION DOCUMENTS

The areas reportedly started being filled in 1958 when the drainage channel along the east and north side of the base was modified in a joint effort by the base and the local flood control district. Concrete rubble was placed along the sides of a portion of the channel (Hardfill Area No. 2). After the new diversion channel was constructed the old channel at the northern part of the base was filled with concrete and other construction debris (Hardfill Area No. 3). Hardfill Area No. 2 also contains some brush, tires, and wood in an area immediately adjacent to the drainage channel.

Hardfill Area No. 4 is a small area near the pesticide burial site which appears to contain primarily asphaltic concrete material. Hardfill Area No. 5, located near the radioactive material burial site, contains asphaltic concrete waste over a larger area than Area No. 4.

Hardfill Area No. 1 is located along the southern installation boundary and contains concrete debris, structural steel, reinforcing bars and wire, wood and asphaltic materials.

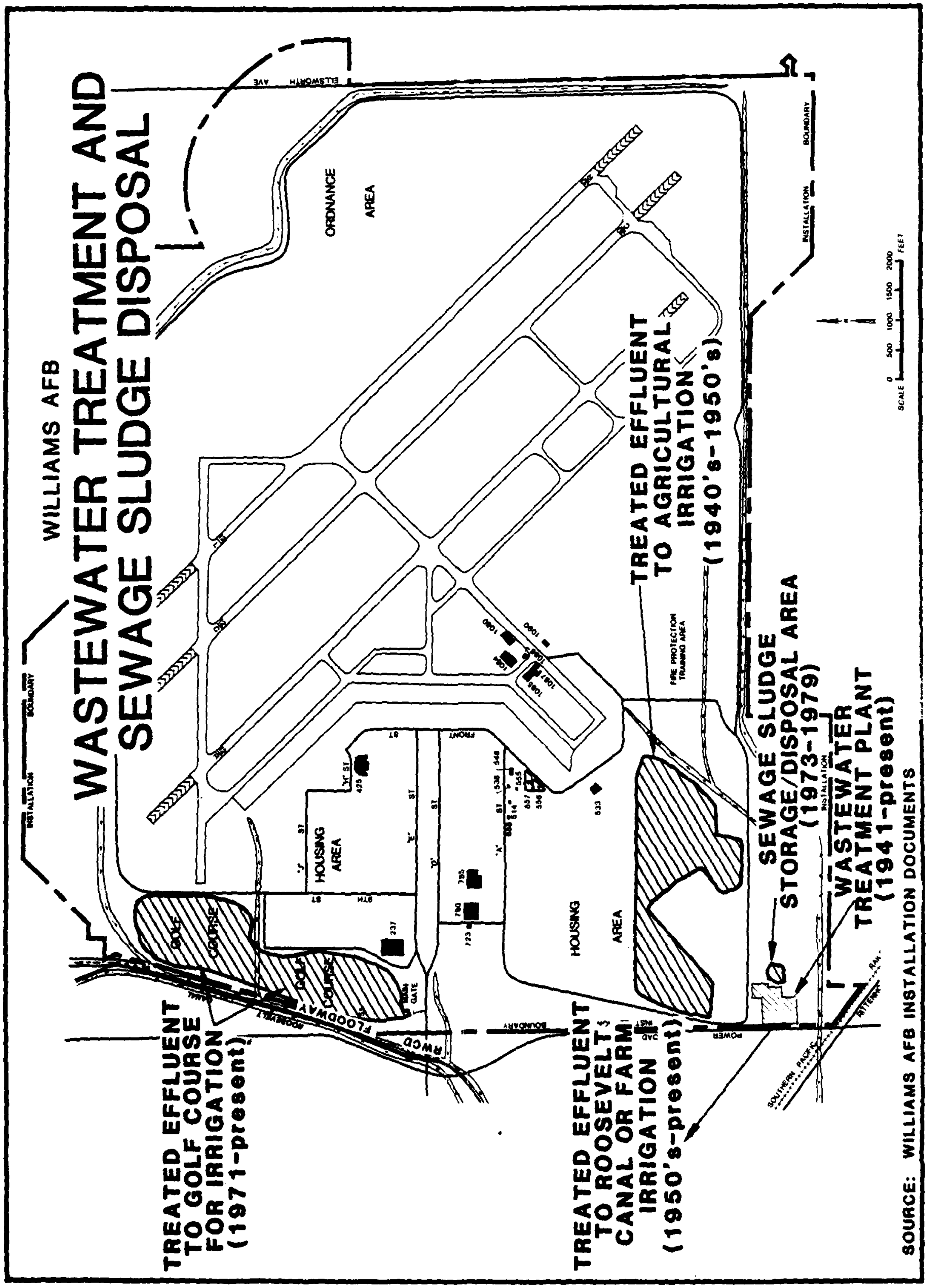
The hardfill areas have not received major quantities of construction and demolition materials since 1978. In the past five years any significant quantity of debris was hauled to off-base disposal areas.

None of the hardfill areas are covered with soil. All debris has been placed at grade level. Through interviews and site reconnaisance it was determined that the only type of non-hardfill type materials placed at the sites are some nearly empty containers of adhesive or joint seal materials (such as roofing cement). These were observed at Hardfill Areas No. 1 and 3 only. Hardfill Area No. 1 also contains 2 or 3 empty drums but there are no reports of any hazardous wastes ever being taken to any of the hardfill sites.

The hardfill areas are not considered to be potential sites for contamination or migration of hazardous materials. However, the uncovered nature of these sites makes them susceptible to disposal of unauthorized wastes if management controls on base are not tight.

Sanitary Sewerage System

All wastewater from the base flows by gravity in a separate sewer system to the treatment plant located in the southwest corner of the installation (see Figure 4.8 and Appendix F photographs).


WILLIAMS AFB
WASTEWATER TREATMENT AND
SEWAGE SLUDGE DISPOSAL
TREATED EFFLUENT
TO GOLF COURSE
FOR IRRIGATION
(1971-present)
TREATED EFFLUENT
TO ROOSEVELT
CANAL OR FARM
IRRIGATION
(1950's-present)
TREATED EFFLUENT
TO AGRICULTURAL
IRRIGATION
(1940's-1950's)
SEWAGE SLUDGE
STORAGE/DISPOSAL AREA
(1973-1979)
WASTEWATER
TREATMENT PLANT
(1941-present)
ORDNANCE
AREA
HOUSING
AREA
HOUSING
AREA
GOLF
COURSE
GOLF
COURSE
FIRE PROTECTION
TRAINING AREA
INSTALLATION
BOUNDARY
ELLSWORTH AVE
FRONT ST
MAIN GATE
RWCD
FLOODWAY
SOUTHERN PACIFIC
SCALE 0 500 1000 1500 2000 FEET
SOURCE: WILLIAMS AFB INSTALLATION DOCUMENTS

The trickling filter treatment plant was constructed in 1942. In 1970 a pond was constructed at the site following the secondary treatment process. Another larger pond was built in 1978-79. These ponds store treated wastewater prior to reuse for irrigation on the base golf course.

Since the 1940's the treated effluent has been used extensively for irrigation water. When wastewater flows exceed irrigation needs the treated effluent is discharged to the adjacent Roosevelt Canal. This usually occurs for only a small portion of the time during a typical year. In the 1940's and 1950's the land north of the treatment plant, south of the housing area and west of FPTA No. 2 was irrigated with effluent. From the late 1950's to 1971 the effluent was discharged off base near the Roosevelt Canal where a local farmer used the water for forage crop irrigation. From 1971 to 1978-1979 some was used for irrigation of the base golf course and some of the wastewater was discharged to the Roosevelt Canal or local farmers. Since 1981 all of the wastewater has been used to water the base golf course.

As noted in Table 4.1 some small quantities of potentially hazardous materials have been discharged to the sanitary sewerage system. In the early 1970's there reportedly were some periodic process upsets attributed to unauthorized disposal of industrial shop wastes to the sewers. Routine monitoring of the plant in recent years has indicated the quality of the effluent is satisfactory for irrigation purposes.

The sanitary sewerage system is not considered a potential for contamination or migration of hazardous materials based upon present or past operations.

Sewage Sludge Disposal Areas

All sludge from the sewage treatment plant has been disposed of on the base. The sludge is anaerobically digested and then dried on drying beds. The dried sludge has been disposed at the base landfill or on the land adjacent to the treatment plant. Dried sludge is currently being mixed with grass and other vegetation in preparation of disposal on the golf course as a compost material.

Prior to 1973 dried sludge was taken to the base landfill. During the period 1973 to 1979 the anaerobic digesters were out of service and three temporary sludge lagoons were excavated adjacent to the eastern

boundary of the wastewater treatment plant site. Dried sludge from the lagoons from 1973-76 was put in the landfill. In 1979, when the digesters became operable, the lagoons containing sludge were covered with soil. From 1979 to the present, sludge has been accumulating in the digesters and on drying beds. Sludge disposal as a compost material on the golf course will begin soon.

Testing of the dried sewage sludge by the base in the past few years has shown that the material does not contain heavy metals.

The sewage sludge disposal areas are not considered a potential for contamination or migration of hazardous materials based upon past and present operations.

Incinerators

From 1941 to 1948 readily combustible wastes such as paper was incinerated at a facility which was located adjacent to the wastewater treatment plant. Wastes not easily combusted were disposed in the base landfill as previously discussed. Ash from the incinerator was placed in the landfill. This incinerator discontinued operation in 1948.

In 1979 a munitions destruction furnace was constructed on the base in the ordnance area (near eastern installation boundary). As shown in Table 4.1, the ash from this incinerator is handled by DPDO.

A small incinerator also exists at USAF Hospital Williams. This is used to burn pathological wastes.

The above described incinerator operations are not considered to be hazardous material contamination or migration problems.

Surface Drainage System

Surface drainage facilities at Williams AFB consist of underground storm sewers and open drainage ditches/channels that convey rainwater off the base. Open ditches drain water away from the areas between runways. The open drainage ditches connect either to larger open channels or to underground sewers. In general, stormwater collected in the outlying areas of the base flows into the flood control channel and off the base. Stormwater collected in areas containing the majority of shops that generate hazardous wastes drains through corrugated metal pipes to a stormwater retention basin (immediately north of the wastewater treatment plant) before it flows off base. Reinforced concrete

pipes convey stormwater from the area bordered by Taxiway Nos. 1, 3 and 6. Water that flows through the concrete pipe storm sewer system is discharged to an open channel that bypasses the stormwater retention basin.

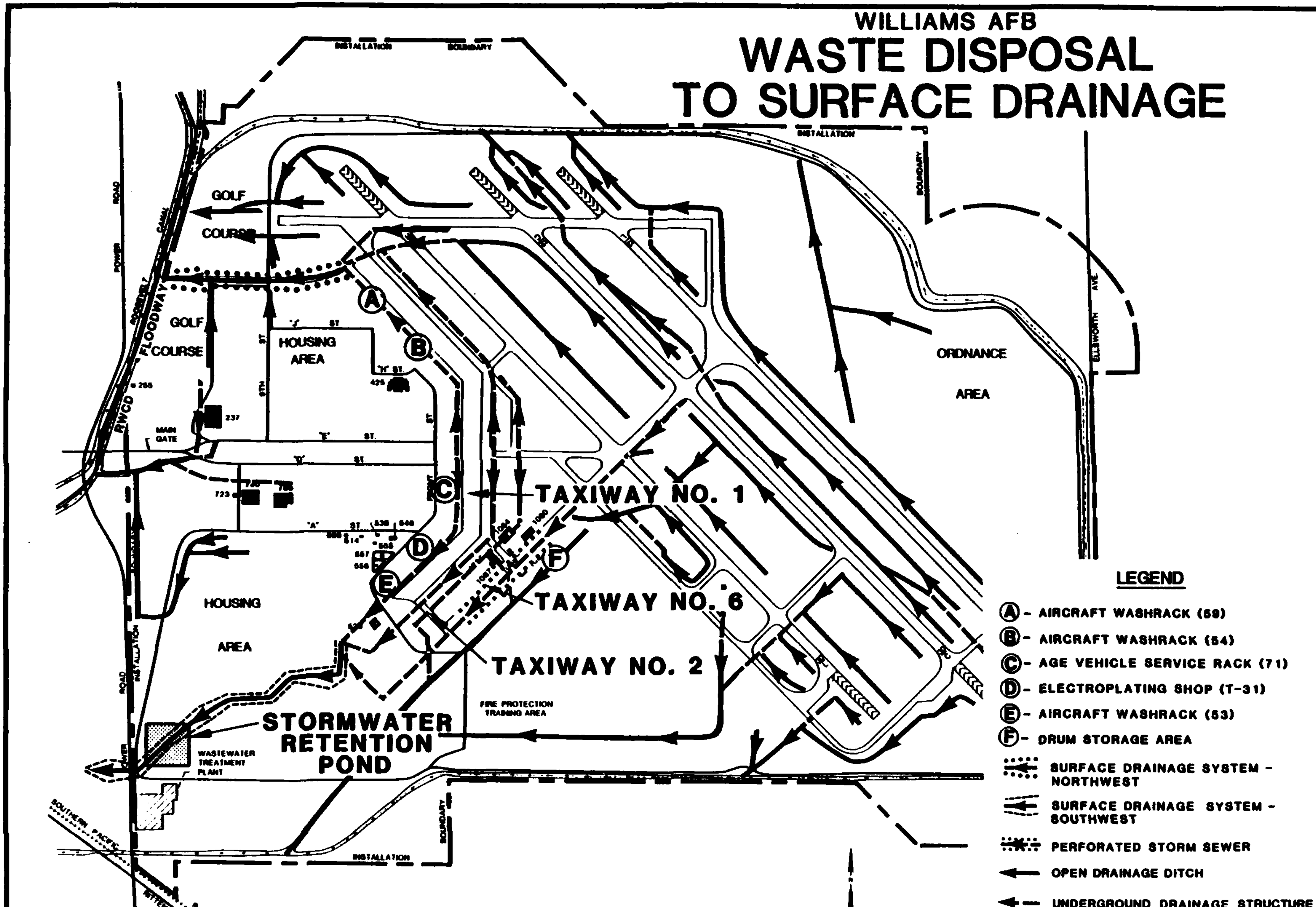
The surface drainage system has been used to dispose of wastes from paint stripping, washing and rinsing operations. The locations of shops, aircraft washracks, and vehicle service racks that disposed of potentially hazardous wastes through the stormwater drainage system are presented in Figure 4.9. The areas of the stormwater drainage system that were used for disposal of the wastes are also shown in this figure.

The stormwater drainage system is used to transport washwater away from vehicle service racks and aircraft washracks. Oil/water separators have been installed at washing facilities and at other locations on the base. There are oil/water or fuel/water separators at Buildings 71, 1092, and 1540; the Aerospace Ground Equipment (AGE) vehicle service rack, the fuel cell shop, and the test cells, respectively. Another oil/water separator is located at aircraft Washrack No. 59. Water flows out of these units into the storm sewer system. Fuel and/or oil that is separated from the water is pumped from the units by an off base contractor.

The fuel/water separators at Buildings 1540 and 1092 were installed at the time of construction of the buildings in 1971 and 1974, respectively. The other two units, at the AGE vehicle service rack and at aircraft washrack 59, were installed in about 1960. Between 1949 and 1960, hazardous wastes from the aircraft washrack, including solvents, degreasers, paints, and thinners, were washed through storm sewers to the northwest drainage system.

Tanks that serve as "sand traps" have been installed on sewer lines from other aircraft washracks (Facilities 53 and 54). Stoddard solvent (PD-680) was used for washing airplanes until approximately 1970. The solvent was washed to floor drains that are connected to the storm sewer system. Since the sandtraps provide no removal of PD-680, the waste from Facility 53 flowed untreated to the stormwater retention basin. The water from Facility 54 flowed to the northwest surface drainage

FIGURE 4.9



SOURCE: WILLIAMS AFB INSTALLATION DOCUMENTS

system. Other sand traps have been installed adjacent to Building 1085 and at the vehicle service racks serving the vehicle maintenance shop, the motor pool, and the auto hobby shop.

The corrugated metal drainage pipe that runs parallel to and on the southeast side of Taxiway No. 6 is perforated along part of its length. A manhole is located along this pipeline upstream of the perforated section between the old and new hazardous material storage areas. There are indications that this manhole may have been used to dump the contents of some hazardous waste drums, however this was not believed to have been a common practice. This storm sewer drains to the stormwater retention basin through the southwest surface drainage system. For purposes of evaluation of contamination or migration the perforated storm sewer is considered to be part of the southwest surface drainage system.

As discussed earlier, electroplating rinsewaters were drained to the stormwater system from the early 1940's to 1959. The rinsewaters were discharged to a storm sewer that connects with the southwest surface drainage system and flows into the stormwater retention basin.

EVALUATION OF PAST DISPOSAL ACTIVITIES AND FACILITIES

Review of past waste generation and management practices at Williams AFB has resulted in identification of 19 sites and/or activities which were considered as areas of concern for potential contamination and migration of contaminants. These sites were evaluated using the Decision Tree Methodology presented in Figure 1.1. Sites not considered to have a potential for contamination were deleted from further evaluation. The sites which have potential for contamination and migration of contaminants were evaluated using the Hazard Assessment Rating Methodology (HARM). Table 4.4 summarizes the results of the decision tree logic for each of the areas of initial concern.

Ten of the 19 sites assessed did not warrant further evaluation. The rationale for omitting these sites from HARM evaluation is discussed below.

Hardfill Area Nos. 1 through 5 received concrete rubble, asphaltic concrete material, structural steel, wood, brush, wire, reinforcing bars, tires, and a few empty containers of adhesive materials. Based

TABLE 4.4
SUMMARY OF DECISION TREE LOGIC FOR AREAS
OF INITIAL ENVIRONMENTAL CONCERN AT WILLIAMS AFB

Site Description	Potential for Contamination	Potential for Contaminant Migration	Potential for Other Environmental Concern	HARM Rating
Fire Protection Training Area No. 1	Yes	Yes	N/A	Yes
Fire Protection Training Area No. 2	Yes	Yes	N/A	Yes
Landfill	Yes	Yes	N/A	Yes
Pesticide Burial Site	Yes	Yes	N/A	Yes
Radioactive Material Burial Site	Yes	Yes	N/A	Yes
Hardfill Area No. 1	No	No	No	No
Hardfill Area No. 2	No	No	No	No
Hardfill Area No. 3	No	No	No	No
Hardfill Area No. 4	No	No	No	No
Hardfill Area No. 5	No	No	No	No
Golf Course (WWTP effluent disposal)	No	No	No	No
Area North of Wastewater Treatment Plant (WWTP effluent disposal)	No	No	No	No
Surface Drainage System-Southwest to Retention Basin	Yes	Yes	N/A	Yes
Surface Drainage System - Northwest	Yes	Yes	N/A	Yes
Pesticide Handling (Bldgs. 722 & 723)	No	No	No	No
Pesticide Handling (Bldg. 255)	No	No	No	No
Hazardous Materials Storage Area	Yes	Yes	N/A	Yes
Liquid Fuels Storage Area Spill and Residue Disposal Sites	Yes	Yes	N/A	Yes
Sewage Sludge Storage/Disposal Area	No	No	No	No

Source: Engineering-Science

upon interviews and visual observation of the wastes at each site, there is no evidence to indicate potential hazardous materials contamination at these five sites.

The golf course and the area north of the wastewater treatment plant both received effluent from the treatment plant for irrigation purposes. The area adjacent to the wastewater treatment plant has been used for sludge lagoons and storage. Recent tests by the base have indicated both the effluent and sludge are not hazardous materials. Past operations at the treatment plant do not suggest the effluent or sludge was hazardous in previous years. Therefore, these three sites were eliminated from further assessment.

Pesticides have been handled at two locations for a long period of time. No major spills have been reported at these sites and present operations do not suggest potential for environmental contamination. Thus these sites were eliminated from further evaluation.

The remaining nine sites identified in Table 4.4 were evaluated using the Hazard Assessment Rating Methodology. The HARM process takes into account characteristics of potential receptors, waste characteristics, pathways for migration, and specific characteristics of the site related to waste management practices. Results of the HARM analysis for the nine sites are summarized in Table 4.5.

The procedures used in the HARM system are outlined in Appendix G and the specific rating forms for the nine sites at Williams AFB are presented in Appendix H. The HARM system is designed to indicate the relative need for follow-on action.

TABLE 4.5
SUMMARY OF HARM SCORES FOR POTENTIAL
CONTAMINATION SOURCES AT WILLIAMS AFB

Rank	Site	Receptor Subscore	Waste Characteristics Subscore	Pathways Subscore	Waste Management	Total
1	Fire Protec-tection Train-ing Area No. 2	57	80	45	1.00	61
2	Liquid Fuels Storage Area	63	80	35	1.00	59
3	Surface Drain-age System - Southwest	69	60	45	1.00	58
4	Landfill	62	60	43	1.00	55
5	Pesticide Bur-ial Site	62	60	43	1.00	55
6	Surface Drain-age System - Northwest	69	48	45	1.00	54
7	Hazardous Ma-terial Stor-age Area	53	32	43	1.00	43
8	Fire Protec-tion Train-ing Area No. 1	53	32	36	1.00	40
9	Radioactive Material Bur-ial Site	57	30	35	0.95	39

Source: Engineering-Science

SECTION 5

CONCLUSIONS

The goal of the IRP Phase I study is to identify sites where there is potential for environmental contamination resulting from past waste disposal practices and to assess the probability of contaminant migration from these sites. The conclusions given below are based on field inspections; review of records and files; review of the environmental setting; interviews with base personnel, past employees, and state and federal government employees; and assessments using the HARM system. Table 5.1 contains a list of the potential contamination sources identified at Williams AFB and a summary of the HARM scores for those sites.

FIRE PROTECTION TRAINING AREA NO. 2

This fire protection training area, which has served the base for most of its years, has sufficient potential to create environmental contamination and follow-on studies are justified. Until the late 1960's this site burned a large quantity of the combustible liquid wastes generated at Williams AFB. These wastes included waste fuel, oils, lubricants, cleaning solvents and some paint stripper. Water was extensively used before each fire which minimized the total impact that may have resulted at this site. However, even with pre-application of water, the quantity which may have percolated to the ground is large. While the current operation has a concrete liner under the fire burn sites to collect residual unburned materials, the extensive period of use without these protective features results in a HARM score of 61.

LIQUID FUELS STORAGE AREA

This site area has sufficient potential to create environmental contamination and follow-on investigation is warranted. The liquid fuels storage area has been subjected to several spills and leaks of 1,000 gallons or more in recent years. These have all occurred within

TABLE 5.1
SITES EVALUATED USING THE HAZARD
ASSESSMENT RATING METHODOLOGY
WILLIAMS AFB

Rank	Site	Operation Period	Final Score[1]
1	Fire Protection Training Area No. 2	1948 - Present	61
2	Liquid Fuels Storage Area	1941 - Present	59
3	Surface Drainage System - Southwest	1941 - Present	58
4	Landfill	1941 - 1976	55
5	Pesticide Burial Site	1968 - 1972	55
6	Surface Drainage System - Northwest	1941 - Present	54
7	Hazardous Material Storage Area	1959 - 1983	43
8	Fire Protection Training Area No. 1	1941 - 1948	40
9	Radioactive Material Burial Site	Pre - 1960	39

(1) This ranking was performed according to the Hazard Assessment Rating Methodology (HARM) described in Appendix G. Individual rating forms are in Appendix H.

the Facility 538, 548 and 555 area and they percolated to the ground. In addition, the site area has been used to periodically dispose of residues removed from fuel tank cleaning operations. The HARM score of 59 is predominately due to the quantity of material spilled and the location with respect to wells and populated areas on the base.

SURFACE DRAINAGE SYSTEM - SOUTHWEST

The surface drainage system which transports runoff southwest to the retention pond has sufficient potential to create environmental contamination and follow-on investigation is warranted. This drainage system has operated since the base was constructed in 1941. It has received plating shop rinsewaters, aircraft washing wastes, and miscellaneous aircraft and vehicle spills from flightline and maintenance operations. Also, drainage from a hazardous waste storage area near Building 1080 may have released wastes to this drainage system. The quantity of metal-bearing and other wastes, close proximity to wells and base population and direct connection to a surface water caused this site to receive a HARM score of 58.

LANDFILL

The landfill has sufficient potential to create environmental contamination and follow-on study is warranted. The landfill received small quantities of hazardous wastes but operated for a long period (1941-1976). The receptor and waste characteristic subscores primarily contributed to the HARM score of 55 for this site.

PESTICIDE BURIAL SITE

The site where outdated pesticides were buried in the years 1968-1972 has sufficient potential to create environmental contamination to warrant additional follow-on investigation activities. Approximately four to five times pesticides were buried at this site and signs were erected marking the location of the burial. Due to the receptor factors and the potential persistent nature of the wastes, this site received a HARM score of 55.

SURFACE DRAINAGE SYSTEM - NORTHWEST

The surface drainage system which serves a portion of the flightline and drains north and west has sufficient potential to create environmental contamination and follow-on investigation is justified. This drainage system has served the base since the early 1940's and has received spills from the flightline, aircraft washing solutions and possibly aircraft stripping and shop wastes. The high receptor subscore caused by close proximity to wells and populated areas was the primary contributing factor to the HARM score of 54.

HAZARDOUS MATERIALS STORAGE AREA

The hazardous materials storage area near Building 1080 was a suspected location for spillage or leakage of hazardous wastes. However, due to the low quantity of suspected wastes and the relatively moderate receptor subscore, this site received a final HARM score of 43. This site is judged to have minimal potential to create environmental contamination. Thus, unless other data are collected to support the need for additional investigation, none is warranted.

FIRE PROTECTION TRAINING AREA NO. 1

This FPTA burned waste fuels and other combustibles for a few years during the early years at the base (until 1948). The site location is somewhat indefinite due to the long period of time since its use. FPTA No. 1 is judged to have minimal potential to create environmental contamination and no additional investigation is warranted unless other data are collected to support such need. The HARM score received by this site was 40.

RADIOACTIVE MATERIAL BURIAL SITE

The radioactive material at the burial site at the southern edge of the base is believed to have been placed prior to 1960. There is reason to believe that this site has no potential to create environmental contamination. The site received a HARM score of 39 primarily due to the higher receptor subscore.

SECTION 6
RECOMMENDATIONS

Nine sites were identified at Williams AFB as having the potential for environmental contamination. These sites have been evaluated and rated using the HARM system which assesses their relative potential for contamination and provides the basis for determining the need for additional Phase II, IRP investigation. Six of the nine sites have sufficient potential to create environmental contamination and warrant Phase II investigations. The sites evaluated have been reviewed concerning land use restrictions which may be applicable.

RECOMMENDED PHASE II MONITORING

The subsequent recommendations are made to further assess the potential for environmental contamination from waste disposal areas at Williams AFB. The recommended actions are generally one-time sampling programs to determine if contamination does exist at the site. If contamination is identified in this first-step investigation, the Phase II sampling program will probably need to be expanded to define the extent and type of contamination. The recommended monitoring program is summarized in Table 6.1 and discussed below. Figure 6.1 identifies the six sites for recommended monitoring. It is noted that due to the deep water table no monitoring wells are recommended in the initial part of the Phase II program. Soil and sediment samples will be obtained, water extractions on the soil samples performed and analyses conducted on the extracts to determine evidence of contamination.

1. Fire Protection Training Area No. 2. It is recommended that 12 soil borings (including one control) and 6 soil samples (minimum) per boring be taken in the fire protection training area as outlined in Table 6.1. The soil samples should be taken near the locations where burning has taken place in past years and also

TABLE 6.1
RECOMMENDED MONITORING PROGRAM FOR PHASE II
IRP AT WILLIAMS AFB

Site (Rating Score)	Recommended Monitoring Program*
Fire Protection Training Area No. 2 (61)	Obtain 3 soil borings around each old fire pit,, 2 borings located around the site between the pits, and 4 borings (including control) in the vicinity of the old drum storage area and site runoff area. Take 10-foot deep borings. Collect samples at the following depths and at any major soil interface: 0.5, 1.5, 3.5, 5.5, 7.5 and 10.0 feet. Fill and compact sample holes with clay. Analyze water extractions performed on the soil samples for the parameters in List A, Table 6.2. Perform analyses on the shallow samples first to determine the need for testing the deeper ones.
Liquid Fuels Storage Area (59)	Obtain 2 soil borings in each of the spill and leak areas identified at Facilities 538, 548 and 555 (see Figure 4.4) plus 1 control boring. In the leak area (548) take 20-foot deep borings and in the spill areas (538 and 555) obtain 10-foot borings. Collect samples at the following depths and any major soil interface for the spill area borings: 0.5, 1.5, 3.5, 5.5, 7.5 and 10.0 feet. For the leak area take samples at 3-foot intervals. Fill and compact sample holes with clay. Analyze water extractions for the parameters in List A, Table 6.2. Perform analyses on the shallow samples first for the spill area borings to determine the need for testing the deeper ones. Use field observations for determining analysis priorities on the leak area samples.
Surface Drainage System - Southwest (58)	Using a hand auger obtain soil samples at 4 locations in the open drainage channel and 1 in the retention pond plus 1 control. Collect a surface sediment sample and another sample 4.0 feet deep. Fill and compact sample holes with clay. Analyze water extractions on the soil samples for the parameters in List B, Table 6.2.

TABLE 6.1
RECOMMENDED MONITORING PROGRAM FOR PHASE II
IRP AT WILLIAMS AFB

(Continued)

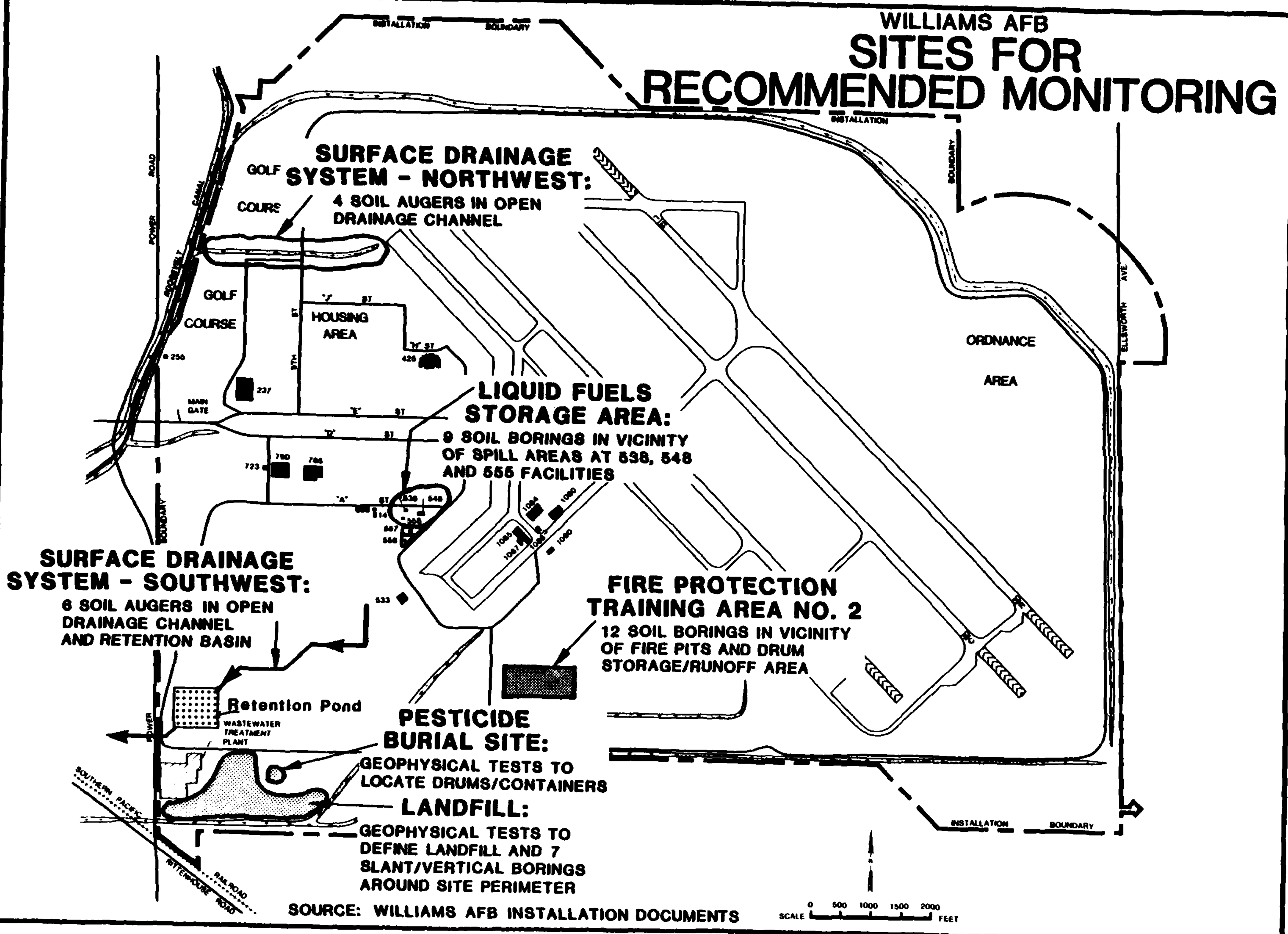
Landfill (55)	Conduct geophysical survey using electromagnetic conductivity techniques to define the boundary of the filled area. Using these data locate and obtain 6 slanted soil borings spaced at regular intervals around the perimeter of the site. These borings will be angled to avoid penetrating the filled area but designed to obtain soils information beside and under the fill. Total boring length will vary by location, probably 50-100 feet. Slant borings on the southern perimeter may be shorter than those on other sides when tanken in the adjacent drainage channel. One vertical control boring will also be required. Collect samples at 2 to 4 foot intervals beside/under the landfill and analyze the water extracts for the parameters in List C, Table 6.2. Fill and compact sample holes with clay.
Pesticide Burial Site (55)	Conduct geophysical survey using either electromagnetic conductivity or magnetometer techniques to define the specific area where drums and/or containers are buried. No sampling or analytical work is recommended in Phase II; instead it will be more cost-effective and environmentally expedient to excavate and remove the buried containers as discussed in "Other Recommendations" in Section 6.
Surface Drainage System - Northwest (54)	Using a hand auger obtain soil samples at 3 locations in the open drainage channel and 1 control. Collect a surface sediment sample and another sample 4.0 feet deep. Fill and compact sample holes with clay. Analyze water extractions on the soil samples for the parameters in List D, Table 6.2.

* If contamination is identified, this soil sampling program may need to be expanded to define the extent and type of contamination.

Source: Engineering-Science, Inc.

FIGURE 6.1

WILLIAMS AFB
SITES FOR RECOMMENDED MONITORING



where the extensive number of drums were stored prior to burning. Samples should also be taken in the normal surface runoff pattern on the site. The sampling interval in each boring should be relatively close near the surface. Water extractions should be performed on the soil samples and the extracts analyzed for the parameters enumerated in Table 6.2. Analyses should be performed on the shallow samples first before deciding on the need to analyze the deeper samples. If the results of the soil sampling and analytical program indicate contamination, then more comprehensive investigations will need to be conducted as a part of Phase II.

2. Liquid Fuels Storage Area. Nine soil borings (including one control) and 6 soil samples (minimum) per boring are recommended throughout the fuels storage area (Facilities 538, 548 and 555) for characterizing the impact from reported spills, leaks and tank residue disposal. For the spill areas, the sampling interval in each boring should be relatively close near the surface and then increased with depth (like FPTA No. 2). Results of analyses on a few samples from each boring should be utilized to determine the need for conducting tests on the remaining samples. As with FPTA No. 2, the results of this first-step investigation will establish the need for more extensive Phase II evaluations.

3. Surface Drainage System - Southwest. For this drainage system it is recommended that 6 hand augers (including one control) be taken in the open drainage channel and retention pond. Two samples would be collected per auger. If the first-stage sampling and analysis program (Tables 6.1 and 6.2) reveal contamination, the Phase II investigation will need to be expanded.

4. Landfill. A geophysical survey is recommended for the initial part of the landfill investigation to determine the limits of the filled area. Definition of the landfill perimeter will allow the soil borings to be strategically located for slant drilling. Six perimeter borings angled under the landfill base are proposed plus one vertical control boring near the site. The soil samples would be

TABLE 6.2
RECOMMENDED ANALYTICAL PARAMETERS FOR SOIL SAMPLE EXTRACTS
WILLIAMS AFB

<u>LIST A (Fire Protection Training Area No. 2 and Liquid Fuels Storage Area)*</u>

- Total Organic Halogens
- Oil and Grease
- Phenols
- Lead

<u>LIST B (Surface Drainage System - Southwest)*</u>

- Total Organic Halogens
- Cadmium
- Chromium
- Copper
- Cyanide
- Lead
- Methyl Ethyl Ketone
- Phenols
- Oil and Grease

<u>LIST C (Landfill)*</u>

- Total Organic Halogens
- Oil and Grease
- Phenols
- Lead
- Chromium
- Cadmium

<u>LIST D (Surface Drainage System - Northwest)*</u>

- Total Organic Halogens
- Oil and Grease
- Phenols
- Lead
- Methyl Ethyl Ketone

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* If contamination is identified, the parameters may need to be altered to assist in defining the extent and type of contamination.

Source: Engineering-Science, Inc.

taken at appropriate intervals under and adjacent to the fill site. Results of these initial investigations at the landfill will determine the need for more extensive activities as a part of Phase II.

5. Pesticide Burial Site. A geophysical survey is recommended to identify the specific area where pesticide drums and other containers are buried within the vicinity of the posted warning signs at this site. The number of drums/containers is believed to be small based upon information gathered in this study. Location of the buried material is the only activity recommended for Phase II at this site.

6. Surface Drainage System - Northwest. It is recommended that 4 hand augers (including one control) be taken in the open drainage channel. Two samples per auger would be collected. More extensive Phase II investigation will be required if this first step reveals contamination.

OTHER RECOMMENDATIONS

The number of containers buried at the pesticide disposal site is reportedly low and the area where they are buried appears to be relatively small. Phase II recommendations for this site include location surveys but no sampling or analytical activities. Due to the low number of containers and small disposal area it will be more cost-effective and environmentally expedient to excavate the buried material and remove it to an approved off-base disposal site. Excavation and removal will probably avoid extensive Phase II monitoring work and at the same time mitigate potential contamination and migration of the wastes in future years. However, if excavation of the containers reveals leakage has occurred, several soil borings/samples and extensive analytical work for pesticides will be necessary in addition to removal of the buried material.

RECOMMENDED GUIDELINES FOR LAND USE RESTRICTIONS

It is desirable to have land use restrictions for the identified sites to (1) provide continued protection of human health, welfare, and

environment, (2) insure that migration of potential contaminants is not promoted through improper land uses, (3) facilitate compatible development of future USAF facilities and (4) allow identification of property which may be proposed for excess or outlease.

The recommended guidelines for land use restrictions at each identified disposal site at Williams AFB are presented in Table 6.3. A description of the land use restriction guidelines is included in Table 6.4. Land use restrictions at sites recommended for on-site monitoring should be re-evaluated upon completion of the Phase II program and appropriate changes made.

TABLE 6.3
RECOMMENDED GUIDELINES AT POTENTIAL CONTAMINATION SITES FOR LAND USE RESTRICTIONS
WILLIAMS AFB

Site	Recommended Guidelines for Future Land Use Restrictions[1]											
	Construction on the site	Excavation	Well construction on or near the site	Agricultural use	Silvicultural use	Water infiltration (Run-on, ponding, irrigation)	Recreational use	Burning or ignition source	Disposal operations	Vehicular traffic	Material storage	Housing on or near the site
Fire Protection Training Area No. 2	NR	NR	R	NR	R	R	NR	NR	R[2]	NR	NR[3]	R
Liquid Fuels Storage Area	NR	NR	R	NR	R	R	NR	NR	R[2]	NR	NR[3]	R
Surface Drainage System - Southwest	NR	NR	R	NR	R	R	NR	NR	R[2]	NR	NR[3]	R
Landfill	R	R	R	NR	R	R	NR	NR	R[2]	NR	NR[3]	R
Pesticide Burial Area	R	R	R	R	R	R	R	NR	R	R	R	R
Surface Drainage System - Northwest	NR	NR	R	NR	R	R	NR	NR	R[2]	NR	NR[3]	R
Hazardous Materials Storage Area	NR	NR	R	NR	R	R	NR	NR	R[2]	NR	NR[3]	R
Fire Protection Training Area No. 1	NR	NR	R	NR	R	R	NR	NR	R[2]	NR	NR[3]	R
Radioactive Material Burial Site	R	R	R	R	R	R	R	NR	R	R	R	R

(1) See Table 6.4 for description of guidelines.
Note the following symbols in this table:
R = Restrict the use of the site for this purpose
NR = No restriction of the site for this purpose
NA = Not applicable

(2) Restrict for all wastes except for construction/demolition debris.

(3) No restriction on solid materials but liquids undesirable.

Source: Engineering-Science

TABLE 6.4
DESCRIPTION OF GUIDELINES FOR LAND USE RESTRICTIONS

Guideline	Description
Construction on the site	Restrict the construction of structures which make permanent (or semi-permanent) and exclusive use of a portion of the site's surface.
Excavation	Restrict the disturbance of the cover or subsurface materials.
Well construction on or near the site	Restrict the placement of any wells (except for monitoring purposes) on or within a reasonably safe distance of the site. This distance will vary from site to site, based on prevailing soil conditions and ground-water flow.
Agricultural use	Restrict the use of the site for agricultural purposes to prevent food chain contamination.
Silvicultural use	Restrict the use of the site for silvicultural uses (root structures could disturb cover or subsurface materials).
Water infiltration	Restrict water run-on, ponding and/or irrigation of the site. Water infiltration could produce contaminated leachate.
Recreational use	Restrict the use of the site for recreational purposes.
Burning or ignition sources	Restrict any and all unnecessary sources of ignition, due to the possible presence of flammable compounds.
Disposal operations	Restrict the use of the site for waste disposal operations, whether above or below ground.
Vehicular traffic	Restrict the passage of unnecessary vehicular traffic on the site due to the presence of explosive material(s) and/or of an unstable surface.
Material storage	Restrict the storage of any and all liquid or solid materials on the site.
Housing on or near the site	Restrict the use of housing structures on or within a reasonably safe distance of the site.

TABLE OF CONTENTS
APPENDICES

TABLE OF CONTENTS (Continued)

APPENDIX A

BIOGRAPHICAL DATA

Biographical Data

ROBERT L. THOEM
Civil/Environmental Engineer

PII Redacted

[redacted]

Education

B.S. Civil Engineering, 1962, Iowa State University, Ames, IA
M.S. Sanitary Engineering, 1967, Rutgers University, New Brunswick, NJ

Professional Affiliations

Registered Professional Engineer (Alabama No. 10580, Georgia No. 10391, Iowa No. 5802, Illinois No. 62-32684, South Carolina No. 9178 and Virginia No. 13461)
American Academy of Environmental Engineering (Diplomate)
American Society of Civil Engineers (Fellow)
National Society of Professional Engineers (Member)
Water Pollution Control Federation (Member)

Honorary Affiliations

Who's Who in Engineering
Who's Who in the Midwest
USPHS Traineeship

Experience Record

1962-1965 U.S. Public Health Service, New York, NY. Staff Engineer, Construction Grants Section (1962-1964). Technical and administrative management of grants for municipal wastewater facilities in New York, Pennsylvania, New Jersey and Delaware.

Water Resources Section Chief (1964-1965). Supervised preparation of regional water supply and pollution control reports.

1966-1983 Stanley Consultants, Muscatine, IA and Atlanta, GA. Project Manager and Project Engineer (1966-1973). Responsible for managing studies and preparing reports for a variety of industrial and governmental environmental projects.

Environmental Engineering Department Head (1973-1976). Supervised staff involved in conducting studies and preparing reports concerning water and wastewater

8/83

Robert L. Thoem (Continued)

systems, solid waste and resource recovery and water resources projects (industrial and governmental).

Resource Management Department Head (1976-1982). Responsible for multidiscipline staff engaged in planning and design of water and wastewater systems, solid waste and resource recovery, water resources, bridge, site development and recreational projects (industrial, domestic and foreign governments).

Associate Chief Environmental Engineer (1980-1983). Corporate-wide quality assurance responsibilities on environmental engineering planning projects.

Operations Group Head and Branch Office Manager (1982-1983). Directed multidiscipline staff responsible for planning and design of steam generation, utilities, bridge, water and wastewater systems, solid waste and resource recovery, water resources, site development and recreational projects (industrial, domestic and foreign governments). Administered branch office support activities.

Project Manager/Engineer for over 25 industrial projects including iron and steel, industrial coke, distillery, tannery, poultry, meat, automotive, forging, plating, paper, plastic and aluminum operations. Responsibilities included studies, reports and preliminary designs for service water systems, wastewater treatment and pretreatment, oil removal, recirculation and cooling (water/wastewater/recirculation flows to 47,000 gpm at one plant), boiler feedwater treatment, storm drainage, residual waste disposal (to 1,000 tons per day) and/or solid waste disposal with energy recovery (to 45 tons per day).

Project Manager for over 25 city and county projects ranging in present study area population from 1,400 to 1,700,000. Investigations included water supply and treatment; water storage, pumping and distribution using computer modeling; wastewater collection and treatment (201 studies for plants to 120 mgd); sludge processing and disposal; storm drainage; and/or solid waste collection, disposal and resource recovery systems (to 4500 tons per day for one county).

Project Manager for over 10 regional (multi-county) planning or operating agency projects. Projects included comprehensive evaluation of sludge thickening, conditioning, stabilization, dewatering, incineration, thermal treatment, drying, fertilizer production, landspreading and landfill (at a 290 mgd metro plant with 460 tons dry solids per day); solid waste collection, resource recovery, and disposal; water and

Robert L. Thoem (Continued)

sewer master plans; and 208 areawide plans for major metropolitan regions covering point source wastewater management, nonpoint source controls, water quality management, and institutional/financial arrangements.

Project Manager for five state agency projects concerning water quality management, waste load allocations (303e and 208 programs), statewide sewage sludge disposal guidelines, and/or statewide solid waste resource recovery options. Also served three state universities on water distribution system, refuse incineration with energy recovery and steam plant planning projects.

Project Manager/Engineer on over 10 projects for federal agencies. Studies included wastewater management for several major urban areas; leather tanning and finishing industry wastewater effluent guidelines; wastewater and water planning, design and operation manuals; solid waste collection and disposal; flood control and statewide river navigability.

Project Manager on several projects for Middle East governments including design of a 48-inch diameter high-pressure water transmission line and an environmental assessment of a $1.7 billion wastewater system improvement program serving a metropolitan area of over nine million people.

1983-Date Engineering-Science. Senior Project Manager. Responsible for managing a variety of environmental projects. Investigated the potential migration of contaminants resulting from past disposal practices at a U. S. Air Force base under the Phase I Installation Restoration Program. Evaluated solid waste collection, disposal and potential for resource recovery at a U. S. Army post. Performed cost allocation study for purposes of determining financial responsibilities among major users of a wastewater treatment plant.

Publications and Presentations

"Analysis of Dissolved Oxygen and the Application of Artificial Aeration in the Upper Passaic River," M.S. Thesis, Rutgers University, January 1967.

"Solid Waste System Cost Evaluation and Financing," presented at the Eleventh Annual Water Resources and Design Conference, Iowa State University, February 1973 (Coauthor L. J. Larson).

"Financing Sanitary Landfills," Iowa Municipalities, September 1973.

Discussion of "Basic Data for Solid Waste Pilot Study," ASCE Journal of the Environmental Engineering Division, October 1973.

"Sludge Handling and Disposal Comparisons in the Minneapolis-St. Paul Area," presented at the ASCE Environmental Engineering Division National Specialty Conference, July 1974.

"Project Cost Evaluation Using Probability Concepts," Consulting Engineer, November 1974 (Coauthor K. A. Smith).

"Planning Solid Waste Management for an Urban County," Public Works, November 1974 (Coauthor L. J. Larson).

"Using Probability Concepts for Project Cost Evaluation," Modern Government/National Development, January-February 1978 (Coauthor K. A. Smith).

"New Potable Water Supply for Jordan," presented at the Fiftieth Annual Georgia Water and Pollution Control Association Conference, August 1981.

"New Potable Water Supply for Jordan," presented at the ASCE Water Resources Planning and Management Division National Speciality Conference, March 1983 (Coauthors L. L. Pruitt and R. F. Haskins).

"Jordan Meets Water Supply Challenges," presented at the AWWA Annual National Conference, June 1983 (Coauthor L. L. Pruitt).

"Steel Pipeline Provides New Water Supply for Jordan," presented at the ASCE Speciality Conference on Pipelines in Adverse Environments II, November 1983 (Coauthors C. L. Meyer and M. C. Boner).

Biographical Data

ROBERT S. McLEOD

Hydrologist

PII Redacted

[redacted]

Education

B.S. in Civil Engineering, 1962, University of Illinois
M.S. in Civil Engineering, 1965, University of Wisconsin

Professional Affiliations

Registered Professional Engineer (Georgia No. CE12684)
American Society of Civil Engineers
American Water Resources Association
National Water Well Association

Experience Record

1962-1964	U.S. Army Corps of Engineers. Staff Engineer. Involved in a low-head dam rehabilitation project. Monitored dredging operations for turning basins in small harbors.
1964-1980	U.S. Geological Survey. Project Chief. Supervised a study on the effects of using groundwater to maintain lake levels which involved evaluation of various hydrologic factors in relation to water-level fluctuations and description of the hydrologic system response from pumping groundwater into the lake. Conducted a study on probable future effects of groundwater pumping on an aquifer system using three-dimensional digital-modeling techniques to predict head declines in the water table and underlying deep aquifer and reductions in flow of nearby streams. Supervised a study to evaluate groundwater and surface water hydrology and hydrological changes caused by construction of a reservoir and a floodwater retention structure in a small basin. Developed a digital-computer program which when applied to two-dimensional, confined groundwater flow problems can predict changes in flow caused by pumping. Developed automated data files and support programs for storing and displaying various types of hydrologic records.

0682#

Robert S. McLeod (Continued)

Project Hydrologist. Investigated surface and groundwater supplies in an area of near-surface crystalline rock to determine availability of groundwater as a source of industrial and municipal supplies. Refined flood-frequency relationships for streams to determine 50-year flood levels. Conducted a study on the relationship between low-flow characteristics and basin characteristics to determine magnitude and frequency of low flows from streams. Involved in basic records collection of surface water and groundwater data. Surface water data were collected to aid in defining the statistical properties of and trends in the occurrence of water in streams and lakes. Groundwater data were collected on water-level fluctuations in principal aquifers to monitor natural and man-induced changes and to estimate the severity of climatic cycles on the availability of groundwater.

1980-1982 Law Engineering Testing Company, Atlanta, Georgia. Project Manager. Responsible for coal hydrology studies in Alabama involving geologic and hydrologic analyses of mining sites, descriptions of site geology, and estimates on probable hydrologic consequences of mining as part of the Office of Surface Mining Small Operator Assistance Program.

Director of Analysis and Reporting/Hydrogeologist. Evaluated the feasibility of using salt domes in the Gulf Coast area to store high-level nuclear wastes. Defined site geology, hydrology, and groundwater flow, direction, and rates for contaminant transport.

1982-Date Engineering-Science. Hydrologist. Responsible for groundwater monitoring studies, aquifer testing, contaminant migration studies, and modeling of groundwater systems.

Publications

"Groundwater Occurrence and Movement Related to Aquifer System Models," Workshop Proceedings, Indiana Water Resources - Future Problems and Needs, Purdue University, May 10-11, 1973.

"A Digital Computer Model for Estimating Drawdowns in the Sandstone Aquifer System in Dane County, Wisconsin," Wisconsin Geological and Natural History Survey Information Circular 28, and presented at the National Water Well Association Midwest Conference, September 1973.

Robert S. McLeod (Continued)

"A Digital Computer Model for Estimating Hydrologic Changes in the Aquifer System in Dane County, Wisconsin," Wisconsin Geological and Natural History Information Circular 30, and presented at the American Water Resources Association Tenth National Convention, August 1974.

Papers and Presentations

"Relation Between Groundwater Pumping and Streamflow in the Yahara River Watershed, Wisconsin," presented at the Madison Hydrology Club, November 1978.

"Groundwater Modeling Techniques for Managing Aquifer Systems," presented at the University of Wisconsin Continuing Education Sanitary Engineering Institute, March 1979.

"Water Use Data Collection Program in Wisconsin," presented at the Midwest Groundwater Conference, November 1979.

"Groundwater Flow in the Vicinity of Richton and Cypress Creek Salt Domes, Perry County, Mississippi," presented at the Fifth South-eastern Groundwater Conference, November 1981.

BIOGRAPHICAL DATA

Rocco M. Palazzolo
Environmental Engineer

PII Redacted

[redacted]

Education

B.S. in Civil Engineering, Wayne State University, 1981
M.S. in Environmental Engineering, Georgia Institute of Technology, 1983.

Professional Affiliations

Water Pollution Control Federation

Honorary Affiliation

Tau Beta Pi

Experience Record

1974-1976 R. D. Palazzolo Associates, Consulting Engineers, P.C., Detroit, Michigan. Engineering Assistant responsible for vendor follow-up during expansion of an transmission manufacturing plant. Acted as liaison between automobile manufacturer and vendors of machine tools, fixtures, gages, etc. Duties included preparation of weekly progress reports, maintenance of records, informing vendors of design changes, etc.

1978-1981 R. D. Palazzolo Associates, Consulting Engineers, P.C., Detroit, Michigan. Checked designs of machine tools, fixtures, gages, and materials handling equipment. Also served as Manufacturers' Representative for tool and die shops.

1981-1983 Georgia Institute of Technology, Atlanta, GA. Graduate Research Assistant in projects including development of a means to improve hydraulic behavior of fluidized bed reactors, review and experimental testing of hydraulic models of fluidization and sedimentation, and a study of adsorption enhanced anaerobic treatment of coal gassification wastewater. Responsible for design and construction of experimental apparatus, system operation and maintenance, experimental measurements and analyses, review of

Rocco M. Palazzolo
Page 2

data and preparation of reports. Also taught undergraduate classes in water distribution and sewer system collection design.

1983-Date — Engineering-Science, Inc., Atlanta, GA. Project Engineer responsible for preparation of a RCRA Part B Permit Application. Work included review of hazardous waste management practices and facilities at the plant for compliance with federal and state regulations. Hazardous waste management processes included container and tank storage, disposal in an on-site secure landfill, and treatment by incineration.

Project Engineer responsible for investigation of environmental impact of a closed garbage and rubbish landfill on a proposed apartment development, including investigation of pollution of ground water and surface water in a nearby stream. Work included development of the history of the landfill, field sampling and measurements, review of data, and presentation of recommendations.

Publications

Khudenko, B.M. and Palazzolo, R.M. "Hydrodynamics of Fluidized Bed Reactors for Wastewater Treatment". Proceedings: First International Conference on Fixed Film Biological Processes, April 20-23, 1982, Kings Island, Ohio, Vol. 3, pp. 1288-1334.

Palazzolo, R.M. and Khudenko, B.M. "Development of A New Type of Fluidized Bed Reactor". International Conference on Scale-up of Water and Wastewater Treatment Processes, March 17 and 18, 1983, Edmonton, Alberta, Canada.

APPENDIX B

LIST OF INTERVIEWEES AND OUTSIDE AGENCY CONTACTS

APPENDIX B

LIST OF INTERVIEWEES AND OUTSIDE AGENCY CONTACTS

TABLE B.1

LIST OF INTERVIEWEES

Most Recent Position	Years of Service at Williams AFB
1. Chief of Bioenvironmental Engineering Services, USAF Hospital Williams	1
2. Supervisory Environmental Engineer, 82 CES	5
3. Environmental Specialist, 82 CES	10
4. Real Property Officer, 82 CES	2
5. Structures Superintendent, 82 CES	21
6. Fuels Management Officer, 82 ABG	5
7. Assistant Fire Chief, 82 ABG	10
8. Assistant Fire Chief, 82 ABG	22
9. Assistant Fire Chief (Retired), 82 ABG	27
10. Deputy Fire Chief, 82 ABG	3
11. Civil Engineering Paint Shop Foreman, 82 CES	16
12. Pavements and Utilities Civil Engineer, 82 CES	29
13. Paving Superintendent, 82 CES	31
14. Pavement and Grounds Deputy Chief of Operations, 82 CES	15
15. Pavements and Grounds Quality Assurance Expert, 82 CES	11
16. Vehicle Maintenance Officer, 82 FTW	38
17. Munitions Branch Chief, 82 FTW/RM	1
18. Recreational Services Branch Chief, 82 ABG	11
19. Air Conditioning Shop Foreman, 82 CES	16
20. Exterior Electric Shop Foreman, 82 CES	12
21. Auto Hobby Shop Supervisor, 82 ABG	1

TABLE B.1, Continued

Most Recent Position	Years of Service at Williams AFB
22. NCOIC Parachute/Survival Shop, 82 FMS	4
23. CE Metal Shop Mechanic, 82 CES	19
24. CE Heating Shop Foreman, 82 CES	8
25. Safety NCO, 82 FMS	4
26. Corrosion Control Specialist, 82 FMS	6
27. Electroplating Specialist, 82 FMS	6
28. Welder, 82 FMS	14
29. Gearbox Repair Foreman, 82 FMS	37
30. Aircraft Jet Engine Mechanic, 82 FMS	31
31. Aircraft Painter, 82 FMS	21
32. NCOIC NDI/SOAP, 82 FMS	1
33. Corrosion Control Shop Chief, 82 FMS	4
34. J-85 Engine Repair Foreman, 82 FMS	20
35. Accessories Repair Foreman, 82 FMS	18
36. NCOIC T-38 Inspection, 82 OMS	1
37. Aircraft Maintenance Supervisor, 82 OMS	31
38. Shop Chief, 925 TFTS	18
39. NCOIC AGE, 82 FMS	9
40. Fuel Distribution Systems Mechanic, 82 CES	17
41. Chief of Maintenance, 925 TFTS	1
42. Electroplating Specialist (Retired), 82 FMS	23
43. Mechanic, Water and Wastewater, 82 ABG	10
44. Supervisor, Water and Wastewater, 82 ABG	12

TABLE B.2
OUTSIDE AGENCY CONTACTS

1. Arizona Department of Health Services, Bureau of Water Quality Control, Phoenix, Arizona
   Robert Munari, P.E., Manager of Compliance Unit (602/255-1252)
   Edwin K. Swanson, P.E., Environmental Health Services (602/255-1172)

2. Arizona Department of Water Resources, Phoenix, Arizona
   Frank M. Barrios, P.E., Chief of Planning and Flood Control Division (602/255-1566)
   Richard A. Gessnor, Chief of Operations Branch Water Management (602/255-1566)

3. U.S. Environmental Protection Agency, Region IX, San Francisco, California
   Kathleen Shimmin, Chief of Field Operations Branch (415/974-8071)

4. U.S. Geological Survey Water Resources Division, Phoenix, Arizona
   James G. Brown, Hydrologist (602/261-3188)

5. U.S. Fish and Wildlife Service, Ecological Services, Phoenix, Arizona
   Lesley A. Fitzpatrick, Fishery Biologist (602/241-2493)

APPENDIX C

TENANT ORGANIZATIONS AND MISSIONS

APPENDIX C

TENANT ORGANIZATIONS AND MISSIONS

Following is a listing of the tenant organizations at Williams AFB, along with their respective missions.

425th Tactical Fighter Training Squadron

The 425th is a Tactical Air Command (TAC) function providing a multi-national training program in the F-5 aircraft. It also provides advanced flying training, F-4 checkout and world-wide ferry service.

Air Force Human Resources Laboratory

This laboratory provides Air Force Research and development in the area of education research as it applies to pilot training. Extension research is performed in flight simulation.

1922 Communications Squadron

The 1922nd Communications Squadron manages the air traffic control, navigational aids and communications at Williams AFB. This unit also maintains the base telephone service and interfaces with commercial telephone companies.

Detachment 528, 3751st Field Training Squadron

This unit provides technical training on the maintenance of the F-5, T-37 and T-38 aircraft now in use at Williams AFB.

Detachment 17, 24th Weather Squadron

Detachment 17 provides current and projected weather information to instructors, students and transient pilots for local and cross country flying operations.

Detachment 13, 3314th Management Engineering Squadron

This unit provides special study support for personnel manning requirements and related areas. It also reviews, coordinates and approves various personnel actions.

Detachment 1817, Air Force Office of Special Investigations

Detachment 1817 provides specialized investigative support support for Williams AFB commanders with respect to criminal, counter-intelligence and fraud investigations.

Other Williams Tenant Organizations

Area Defense Counsel, Detachment QD5U

USAF, Civil Air Patrol Liaison, AZ

Air Force Commissary Service

Army and Air Force Exchange Service

APPENDIX D

SUPPLEMENTAL BASE FINDINGS INFORMATION

TABLE D.1

PESTICIDES CURRENTLY USED
WILLIAMS AIR FORCE BASE

Herbicides	Other Pesticides
Paraquat	Baygon
Roundup	Pyrocide
Dowpan	Malathion
2,4-D	Diazinon
Thiram	Chlordane
Dachtal	Dursban
Ureabor	Sevin
* Aatrex	* Termide (Chlordane/Heptachlor)
* Princep	* PT 150 (Pyrethin C&C)
* GWK	* DDVP (Emulsifiable)
* Pramitol	* 6 oz Vapo Bomb (Aerosol)
* Surfland	* 10 oz Vapo Bomb (Aerosol)
	* Purge II - Timed Prethrin (Aerosol)
	Strychnine Alkaloid
	Avitrol
	Gopher Getter
	Pivalyl

* New chemicals in use. Will be included in 1984 Pest Management Plan.

Note: All chemicals applied by contractors since 1972.

Source: Williams AFB records.

TABLE D.2
SUMMARY OF LIQUID FUEL AND WASTE OIL TANKS
WILLIAMS AFB

Facility/Tank No.	Material Stored	No. of Tanks	Total Storage Capacity (Gallons)	Above or Below Ground
Liquid Fuel Tanks				
556	JP-4	1	420,000	Above
557	JP-4	1	840,000	Above
538	JP-4	1	50,000	Below
548	JP-4	10	250,000	Below
548(1)	JP-4	1	12,000	Below
514	MOGAS	1	50,000	Below
688	DIESEL	1	50,000	Below
534	MOGAS	2	24,000	Below
534	DIESEL	1	6,000	Below
1	DIESEL	1	150	Below
18	DIESEL	1	500	Above
87	DIESEL	1	1,000	Below
237	DIESEL	1	10,000	Below
253	DIESEL	1	1,000	Below
712	DIESEL	1	150	Below
715	DIESEL	1	500	Below
762	DIESEL	1	500	Below
764	MOGAS	1	250	Above
1013	DIESEL	1	500	Below
1049	JP-4	1	2,000	Above
1056	DIESEL	1	550	Below
1083	MOGAS	1	550	Below
1089	DIESEL	1	550	Below
1100	DIESEL	1	1,150	Below
1101	DIESEL	1	550	N.D.
1102	DIESEL	1	550	N.D.
1107	DIESEL	1	550	N.D.
1108	DIESEL	1	500	N.D.
1109	DIESEL	1	150	N.D.
1114	DIESEL	1	550	N.D.
1115	DIESEL	1	150	N.D.
1119	DIESEL	1	55	Above
1121	DIESEL	1	500	N.D.
AGE #1	JP-4	1	6,000	Below
AGE #2	MOGAS	1	6,000	Below
1540	JP-4	1	4,000	Above
760	MOGAS	5	50,000	Below
Coolidge-Florence Annex	MOGAS	1	220	Above

(1) Abandoned tank - filled with sand

TABLE D.2 (Continued)
SUMMARY OF LIQUID FUEL AND WASTE OIL TANKS
WILLIAMS AFB

Facility/Tank No.	Material Stored	No. of Tanks	Total Storage Capacity (Gallons)	Above or Below Ground
Coolidge-Florence Annex	DIESEL	1	1,200	Above
Waterdog Annex	MOGAS	1	550	Above
Waterdog Annex	DIESEL(2)	1	1,000(2)	Above
Rittenhouse Annex	JP-4	1	300	Above
Waste Oil Tanks				
32-1	WASTE OIL	1	1,000	Below
48-1	WASTE OIL	1	1,000	Below
491-1	WASTE OIL	1	250	Below
532-1	WASTE OIL	1	500	Below
533-1	WASTE OIL	1	1,000	Below
760-1	WASTE OIL	1	200	Below
1085-1	WASTE OIL	1	280	Below
1085-2	WASTE OIL	1	500	Below
1092-1	WASTE OIL	1	500	Below

Note: N.D - not determined

Source: Williams AFB records

(2) Abandoned empty tank -capacity approximate

APPENDIX E

MASTER LIST OF SHOPS

APPENDIX E

MASTER LIST OF SHOPS

Name	Present Location (Bldg. No.)	Handles Hazardous Materials*	Generates Hazardous Wastes*	Typical TSD Methods
82 AIR BASE GROUP				
Morale, Welfare and Recreation Division				
Auto Hobby Shop	491	Yes	Yes	Off Base Contractor/DPDO
Ceramic Hobby Shop	538	No	No	-
Photo Hobby Shop	539	Yes	Yes	Silver Recovery
Wood Hobby Shop	539	No	No	-
82 Civil Engineering Squadron				
Air Conditioning/Refrigeration	735	Yes	Yes	DPDO
Carpenter/Structures	735	No	No	-
Exterior Electric	735	Yes	Yes	PCB Storage/DPDO
Interior Electric	735	Yes	No	Consumed in Process
Entomology/Pavements & Grounds	722&723	Yes	No	Consumed in Process
Golf Course Maintenance	255	Yes	No	Consumed in Process
Family Housing Maintenance	9551	No	No	-

*As defined on p. 4-2 and in Appendix I.

Name	Present Location (Bldg. No.)	Handles Hazardous Materials*	Generates Hazardous Wastes*	Typical TSD Methods
82 Civil Engineering Squadron (Continued)				
Fire Extinguisher Refill and Maintenance	74	Yes	No	Consumed in Process
Heating	768	Yes	No	Consumed in Process
Paint/Corrosion Control	768	Yes	Yes	Off Base Contractor
Plumbing	768	Yes	No	Consumed in Process
POL Maintenance	537	Yes	Yes	Off Base Contractor
Sheet Metal/Welding	602	Yes	No	Consumed in Process
Power Production	735	Yes	Yes	DPDO
82 FLYING TRAINING WING (FTW)/MAINTENANCE				
82 Field Maintenance Squadron				
Battery	1084	No	No	-
Egress	1080	Yes	No	Consumed in Process
Electric	1084	Yes	Yes	Off Base Contractor
Environmental Systems	1080	Yes	No	Consumed in Process
Fuel Cell/Systems	1092	Yes	No	Consumed in Process

*As defined on p. 4-2 and in Appendix I.

Name	Present Location (Bldg. No.)	Handles Hazardous Materials*	Generates Hazardous Wastes*	Typical TSD Methods
82 Field Maintenance Squadron (Continued)				
Pneudraulics	1080	Yes	Yes	DPDO
Electroplating	1085	Yes	Yes	Off Base Contractor
Wheel and Tire	1080	Yes	Yes	Off Base Contractor/DPDO
NDI/Soap Laboratory	1090	Yes	Yes	Off Base Contractor/DPDO
Instrument Shop	568	Yes	No	Consumed in Process
Chemical Cleaning	1085	Yes	Yes	Off Base Contractor
Aerospace Ground Equipment	24	Yes	Yes	DPDO/Sanitary Sewer
Machine Shop	1080	Yes	Yes	Off Base Contractor/DPDO
Corrosion Control	25,1086	Yes	Yes	Off Base Contractor
Parachute/Survival Equipment	426	Yes	No	Consumed in Process
Structural Repair/ Sheet Metal/Canopy Shop	1084	Yes	No	Consumed in Process
Welding	1085	Yes	No	Consumed in Process
Engine Afterburner	1085	Yes	No	Consumed in Process
Engine Accessory Repair	1085	Yes	Yes	DPDO
Engine Compressor Balance	1085	Yes	No	Consumed in Process

*As defined on p. 4-2 and in Appendix I.

Name	Present Location (Bldg. No.)	Handles Hazardous Materials*	Generates Hazardous Wastes*	Typical TSD Methods
82 Field Maintenance Squadron (Continued)				
Engine Gearbox Repair	1085	Yes	No	Consumed in Process
Engine Disassembly/ Teardown	1085	Yes	No	Consumed in Process
Engine Buildup/Final	1085	Yes	No	Consumed in Process
Engine Test Cell	1540	Yes	Yes	DPDO
82 Organization Maintenance Squadron				
Support Section	38	Yes	Yes	DPDO
T-37 Inspection	31	Yes	Yes	DPDO
T-38 Inspection	32	Yes	Yes	DPDO
Repair/Reclamation	1084	Yes	Yes	DPDO
82 FTW/RESOURCE MANAGEMENT				
Transportation Division				
Vehicle Maintenance Shops	533	Yes	Yes	DPDO
Supply Division				
Fuels Management	547	Yes	Yes	FPTA
Munitions	1124	Yes	Yes	DPDO

*As defined on p. 4-2 and in Appendix I.

Name	Present Location (Bldg. No.)	Handles Hazardous Materials*	Generates Hazardous Wastes*	Typical TSD Methods
425 TACTICAL FIGHTER TRAINING SQUADRON				
Aircraft Generation Branch	75	Yes	Yes	DPDO
Component Repair Branch	46	Yes	Yes	DPDO
Support Branch	75	Yes	Yes	DPDO
Photographic Processing Lab	41	Yes	Yes	Silver Recovery
Weapons	41	No	No	-
Life Support	41	Yes	No	Consumed in Process
1922 COMMUNICATIONS SQUADRON				
Communications Operations	762	No	No	-
Telephone Maintenance	762	No	No	-
NAVAIDS Maintenance	683	No	No	-
Radar Maintenance	1089	No	No	-
Radio Maintenance	1101	No	No	-
Teletype Maintenance	19	No	No	-
USAF HOSPITAL WILLIAMS				
Clinical Laboratory	237	Yes	Yes	Incineration Luke AFB
Dental Laboratory	237	Yes	No	Consumed in Process

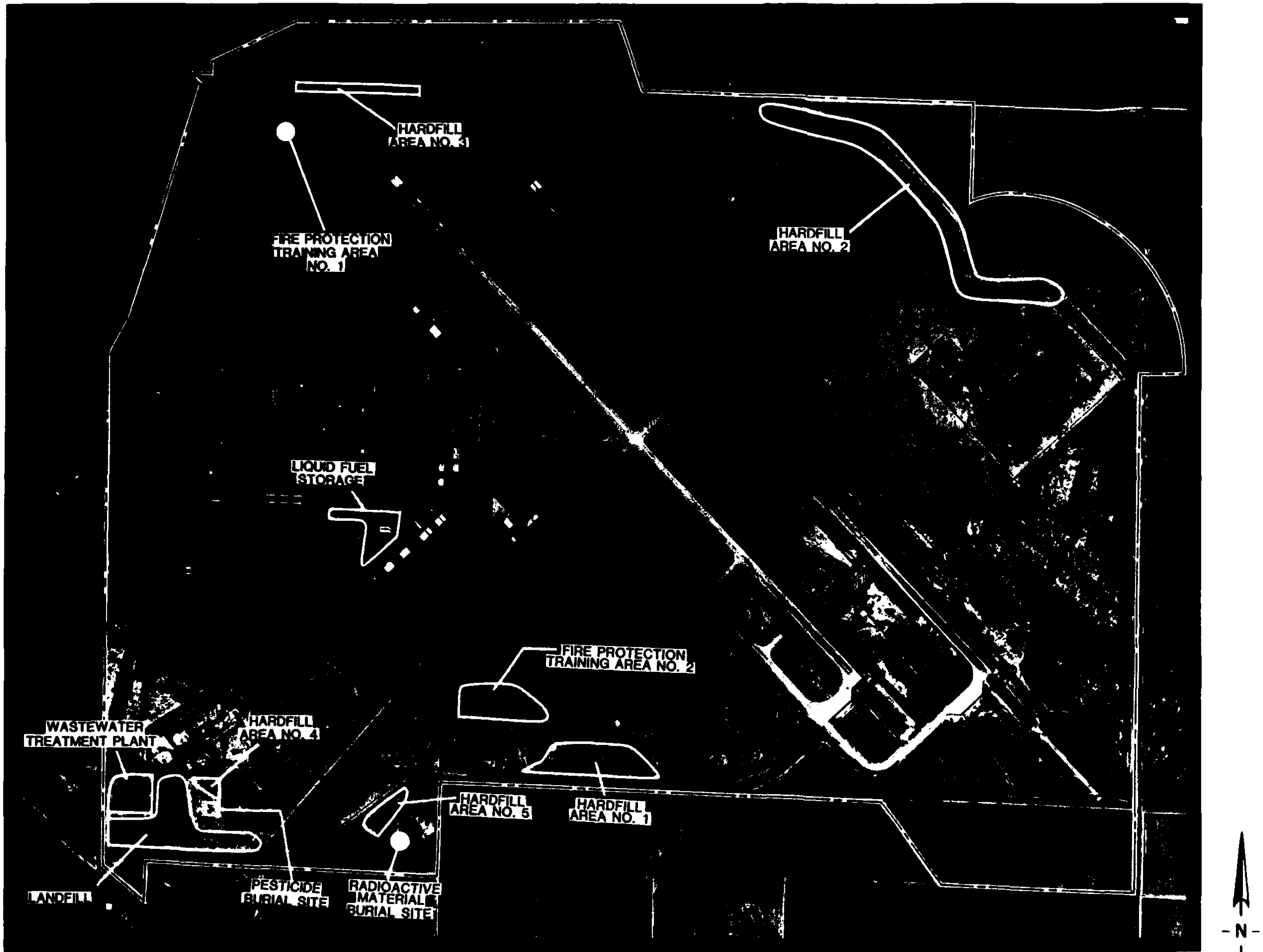
*As defined on p. 4-2 and in Appendix I.

Name	Present Location (Bldg. No.)	Handles Hazardous Materials*	Generates Hazardous Wastes*	Typical TSD Methods
USAF HOSPITAL WILLIAMS (Continued)				
Dental X-Ray	237	Yes	Yes	Silver Recovery
Facility Maintenance	237	No	No	-
Medical Maintenance	237	No	No	-
Medical X-Ray	237	Yes	Yes	Silver Recovery
Pathology	237	Yes	Yes	Incineration
DETACHMENT 17, 24TH WEATHER SQUADRON				
Weather Equipment Maintenance	19	Yes	Yes	Off Base Contractor

*As defined on p. 4-2 and in Appendix I.

APPENDIX F

PHOTOGRAPHS



WILLIAMS AFB
1967 - 1968

WILLIAMS AFB

FACING SOUTHEAST

FACING NORTHWEST

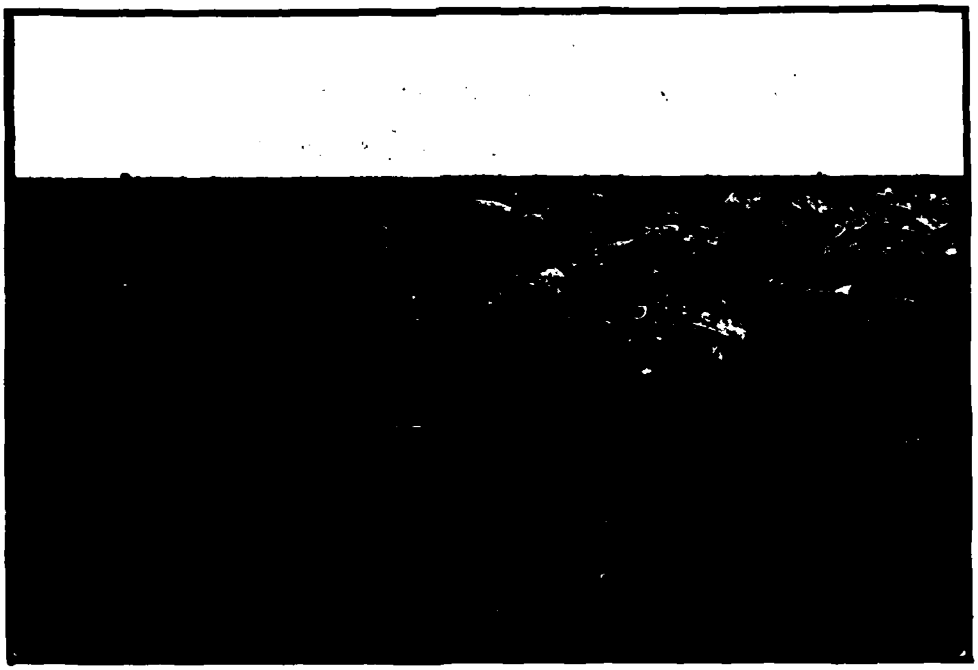
FIRE PROTECTION TRAINING AREA

WILLIAMS AFB

FACING WEST

HARDFILL AREA NO. 1

FACING NORTHEAST



HARDFILL AREA NO. 2

WILLIAMS AFB

FACING NORTHEAST

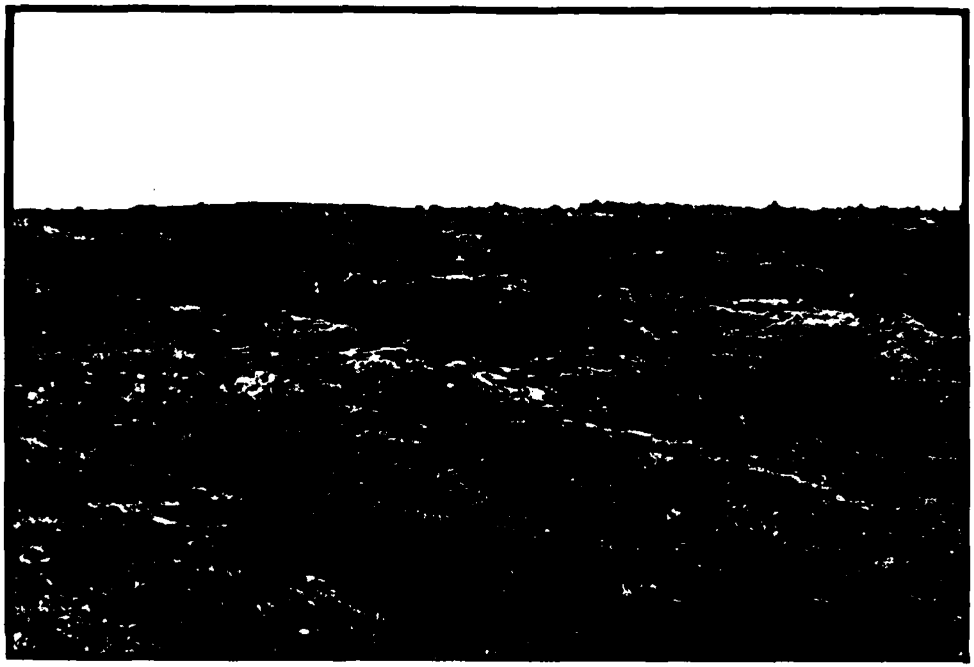
HARDFILL AREA NO. 5

FACING NORTHEAST

RADIOACTIVE MATERIAL BURIAL SITE

WILLIAMS AFB

FACING EAST

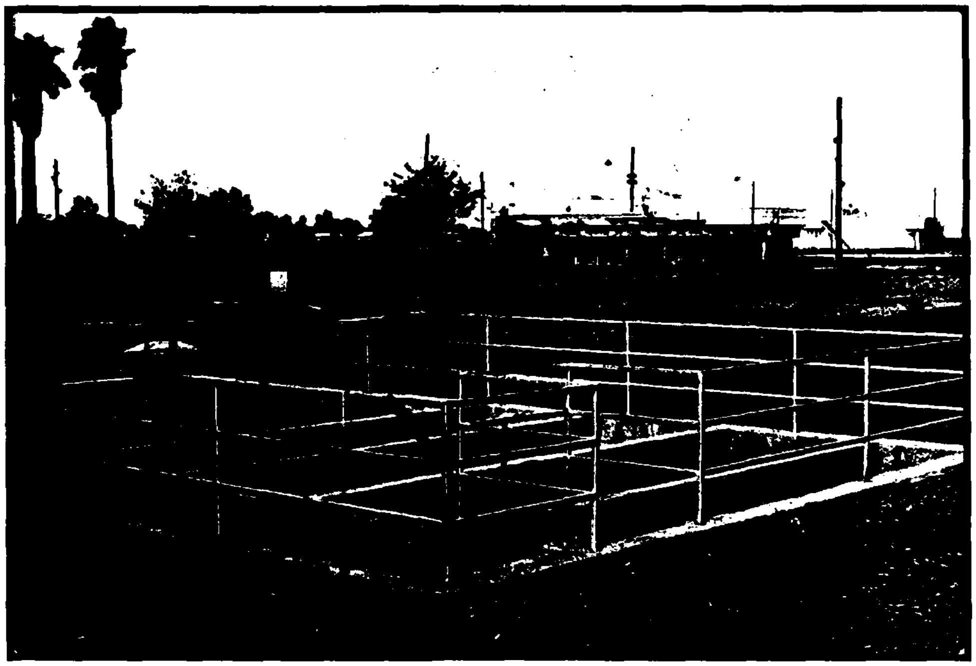


FACING EAST

LANDFILL

WILLIAMS AFB

FACING NORTHEAST



WASTEWATER TREATMENT PLANT

FACING NORTHWEST

WASTEWATER TREATMENT PLANT (Background)

LANDFILL (Foreground)

WILLIAMS AFB

FACING SOUTH

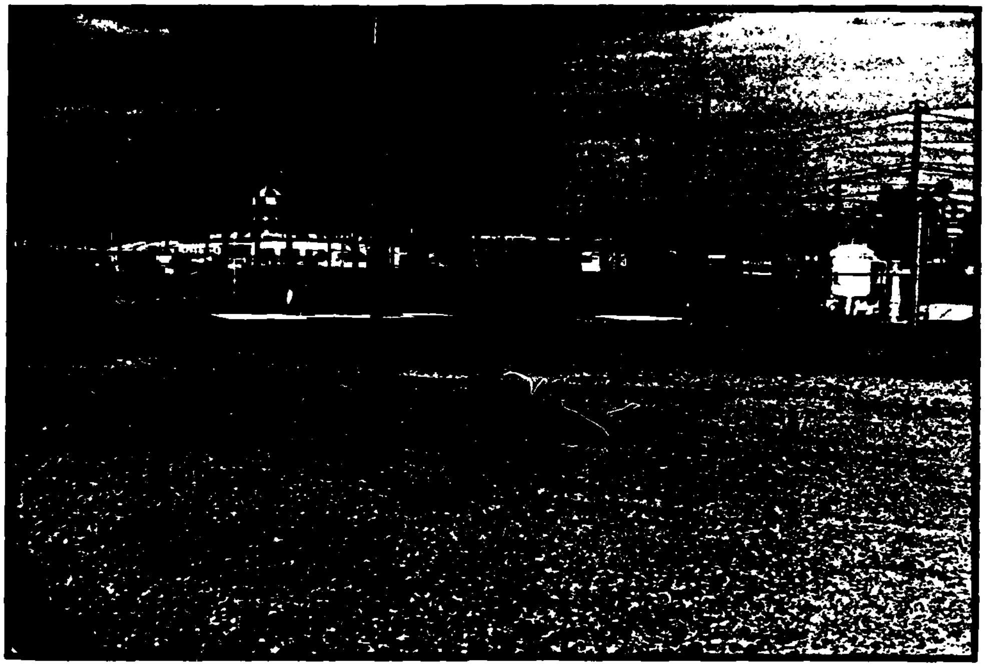
PESTICIDE BURIAL SITE (Foreground)
LANDFILL (Background)

FACING WEST

FUEL STORAGE AREA

WILLIAMS AFB

FACING WEST



FACING EAST

FUEL STORAGE AREA

APPENDIX G

USAF INSTALLATION RESTORATION PROGRAM

HAZARD ASSESSMENT RATING METHODOLOGY

APPENDIX G

USAF INSTALLATION RESTORATION PROGRAM

HAZARD ASSESSMENT RATING METHODOLOGY

BACKGROUND

The Department of Defense (DOD) has established a comprehensive program to identify, evaluate, and control problems associated with past disposal practices at DOD facilities. One of the actions required under this program is to:

> "develop and maintain a priority listing of contaminated installations and facilities for remedial action based on potential hazard to public health, welfare, and environmental impacts." (Reference: DEQPPM 81-5, 11 December 1981).

Accordingly, the United States Air Force (USAF) has sought to establish a system to set priorities for taking further actions at sites based upon information gathered during the Records Search phase of its Installation Restoration Program (IRP).

The first site rating model was developed in June 1981 at a meeting with represenatives from USAF Occupational and Environmental Health Laboratory (OEHL), Air Force Engineering and Services Center (AFESC), Engineering-Science (ES) and CH2M Hill. The basis for this model was a system developed for EPA by JRB Associates of McLean, Virginia. The JRB model was modified to meet Air Force needs.

After using this model for 6 months at over 20 Air Force installations, certain inadequacies became apparent. Therefore, on January 26 and 27, 1982, representatives of USAF OEHL, AFESC, various major commands, Engineering-Science, and CH2M Hill met to address the inadequacies. The result of the meeting was a new site rating model designed to present a better picture of the hazards posed by sites at Air Force installations. The new rating model described in this presentation is referred to as the Hazard Assessment Rating Methodology.

PURPOSE

The purpose of the site rating model is to provide a relative ranking of sites of suspected contamination from hazardous substances. This model will assist the Air Force in setting priorities for follow-on site investigations and confirmation work under Phase II of the IRP.

This rating system is used only after it has been determined that (1) potential for contamination exists (hazardous wastes present in sufficient quantity), and (2) potential for migration exists. A site can be deleted from consideration for rating on either basis.

DESCRIPTION OF MODEL

Like the other hazardous waste site ranking models, the U.S. Air Force's site rating model uses a scoring system to rank sites for priority attention. However, in developing this model, the designers incorporated some special features to meet specific DOD program needs.

The model uses data readily obtained during the Records Search portion (Phase I) of the IRP. Scoring judgments and computations are easily made. In assessing the hazards at a given site, the model develops a score based on the most likely routes of contamination and the worst hazards at the site. Sites are given low scores only if there are clearly no hazards at the site. This approach meshes well with the policy for evaluating and setting restrictions on excess DOD properties.

As with the previous model, this model considers four aspects of the hazard posed by a specific site: the possible receptors of the contamination, the waste and its characteristics, potential pathways for waste contaminant migration, and any efforts to contain the contaminants. Each of these categories contains a number of rating factors that are used in the overall hazard rating.

The receptors category rating is calculated by scoring each factor, multiplying by a factor weighting constant and adding the weighted scores to obtain a total category score.

The pathways category rating is based on evidence of contaminant migration or an evaluation of the highest potential (worst case) for contaminant migration along one of three pathways. If evidence of contaminant migration exists, the category is given a subscore of 80 to 100 points. For indirect evidence, 80 points are assigned and for direct evidence, 100 points are assigned. If no evidence is found, the highest score among three possible routes is used. These routes are surface water migration, flooding, and ground-water migration. Evaluation of each route involves factors associated with the particular migration route. The three pathways are evaluated and the highest score among all four of the potential scores is used.

The waste characteristics category is scored in three steps. First, a point rating is assigned based on an assessment of the waste quantity and the hazard (worst case) associated with the site. The level of confidence in the information is also factored into the assessment. Next, the score is multiplied by a waste persistence factor, which acts to reduce the score if the waste is not very persistent. Finally, the score is further modified by the physical state of the waste. Liquid wastes receive the maximum score, while scores for sludges and solids are reduced.

The scores for each of the three categories are then added together and normalized to a maximum possible score of 100. Then the waste management practice category is scored. Sites at which there is no containment are not reduced in score. Scores for sites with limited containment can be reduced by 5 percent. If a site is contained and well managed, its score can be reduced by 90 percent. The final site score is calculated by applying the waste management practices category factor to the sum of the scores for the other three categories.

FIGURE 1

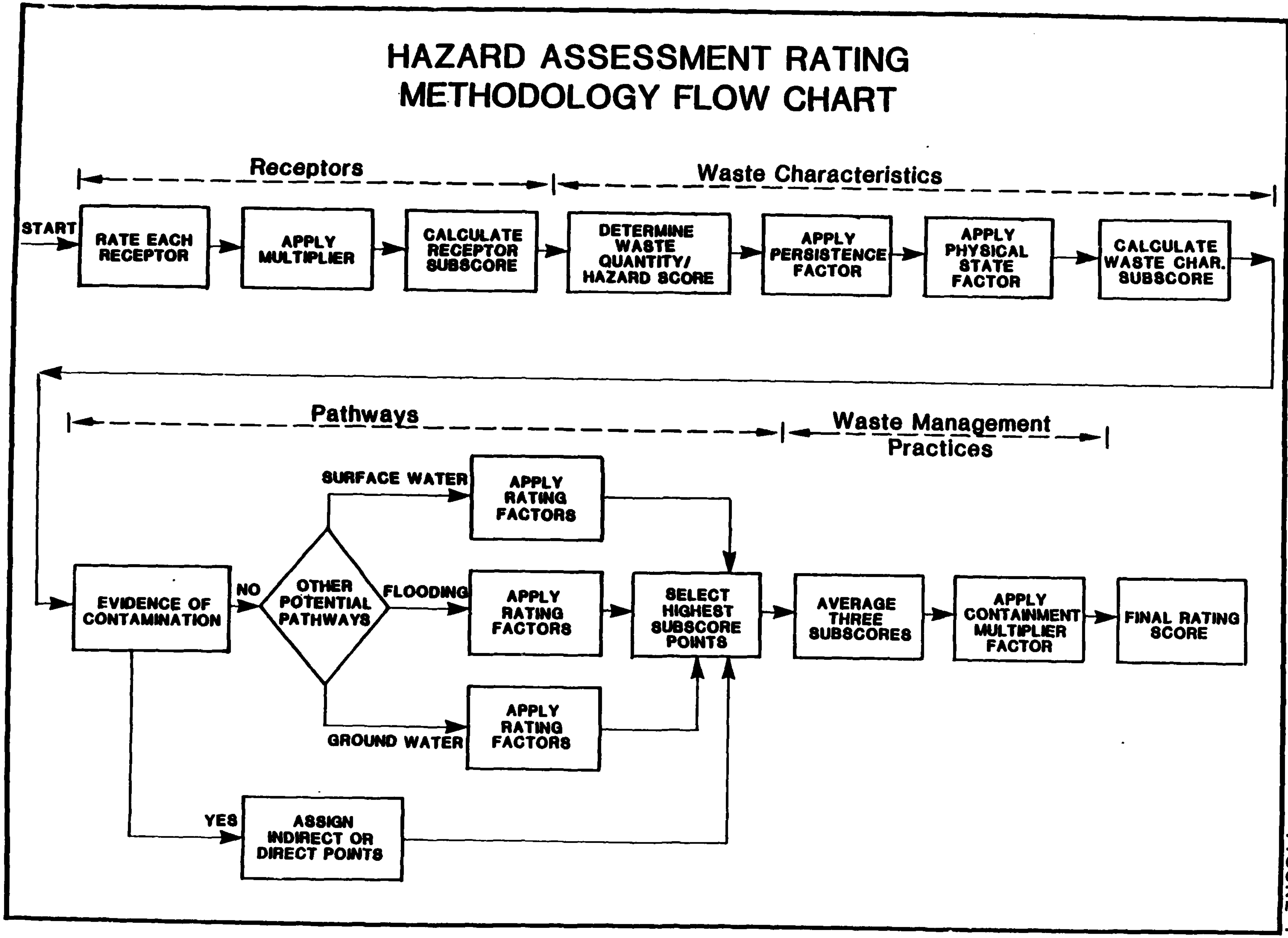

HAZARD ASSESSMENT RATING
METHODOLOGY FLOW CHART
Receptors
Waste Characteristics
START
RATE EACH RECEPTOR
APPLY MULTIPLIER
CALCULATE RECEPTOR SUBSCORE
DETERMINE WASTE QUANTITY/ HAZARD SCORE
APPLY PERSISTENCE FACTOR
APPLY PHYSICAL STATE FACTOR
CALCULATE WASTE CHAR. SUBSCORE
Pathways
Waste Management Practices
EVIDENCE OF CONTAMINATION
NO
OTHER POTENTIAL PATHWAYS
SURFACE WATER
FLOODING
GROUND WATER
APPLY RATING FACTORS
APPLY RATING FACTORS
APPLY RATING FACTORS
YES
ASSIGN INDIRECT OR DIRECT POINTS
SELECT HIGHEST SUBSCORE POINTS
AVERAGE THREE SUBSCORES
APPLY CONTAINMENT MULTIPLIER FACTOR
FINAL RATING SCORE

FIGURE 2

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE ________________

LOCATION ________________

DATE OF OPERATION OR OCCURRENCE ________________

OWNER/OPERATOR ________________

COMMENTS/DESCRIPTION ________________

SITE RATED BY ________________

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site		4		
B. Distance to nearest well		10		
C. Land use/zoning within 1 mile radius		3		
D. Distance to reservation boundary		6		
E. Critical environments within 1 mile radius of site		10		
F. Water quality of nearest surface water body		6		
G. Ground water use of uppermost aquifer		9		
H. Population served by surface water supply within 3 miles downstream of site		6		
I. Population served by ground-water supply within 3 miles of site		6		
		Subtotals	____	____

Receptors subscore (100 X factor score subtotal/maximum score subtotal) ____

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) ____
2. Confidence level (C = confirmed, S = suspected) ____
3. Hazard rating (H = high, M = medium, L = low) ____

Factor Subscore A (from 20 to 100 based on factor score matrix) ____

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

________ X ________ = ________

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

________ X ________ = ________

FIGURE 2 (Continued)

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water		8		
Net precipitation		6		
Surface erosion		8		
Surface permeability		6		
Rainfall intensity		8		

Subtotals ______ ______

Subscore (100 X factor score subtotal/maximum score subtotal) ______

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding		1		

Subscore (100 x factor score/3) ______

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water		8		
Net precipitation		6		
Soil permeability		8		
Subsurface flows		8		
Direct access to ground water		8		

Subtotals ______ ______

Subscore (100 x factor score subtotal/maximum score subtotal) ______

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore ______

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors ______
Waste Characteristics ______
Pathways ______

Total ______ divided by 3 = ______
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

______ X ______ = ______

TABLE 1

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

I. RECEPTORS CATEGORY

Rating Factors	Rating Scale Levels 0	1	2	3	Multiplier
A. Population within 1,000 feet (includes on-base facilities)	0	1 - 25	26 - 100	Greater than 100	4
B. Distance to nearest water well	Greater than 3 miles	1 to 3 miles	3,001 feet to 1 mile	0 to 3,000 feet	10
C. Land Use/Zoning (within 1 mile radius)	Completely remote (zoning not applicable)	Agricultural	Commercial or industrial	Residential	3
D. Distance to installation boundary	Greater than 2 miles	1 to 2 miles	1,001 feet to 1 mile	0 to 1,000 feet	6
E. Critical environments (within 1 mile radius)	Not a critical environment	Natural areas	Pristine natural areas; minor wetlands; preserved areas; presence of economically important natural resources susceptible to contamination.	Major habitat of an endangered or threatened species; presence of recharge area; major wetlands.	10
F. Water quality/use designation of nearest surface water body	Agricultural or industrial use.	Recreation, propagation and management of fish and wildlife.	Shellfish propagation and harvesting.	Potable water supplies	6
G. Ground-Water use of uppermost aquifer	Not used, other sources readily available.	Commercial, industrial, or irrigation, very limited other water sources.	Drinking water, municipal water available.	Drinking water, no municipal water available; commercial, industrial, or irrigation, no other water source available.	9
H. Population served by surface water supplies within 3 miles downstream of site	0	1 - 50	51 - 1,000	Greater than 1,000	6
I. Population served by aquifer supplies within 3 miles of site	0	1 - 50	51 - 1,000	Greater than 1, 000	6

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

II. WASTE CHARACTERISTICS

A-1 Hazardous Waste Quantity

S = Small quantity (<5 tons or 20 drums of liquid)
M = Moderate quantity (5 to 20 tons or 21 to 85 drums of liquid)
L = Large quantity (>20 tons or 85 drums of liquid)

A-2 Confidence Level of Information

C = Confirmed confidence level (minimum criteria below)

- o Verbal reports from interviewer (at least 2) or written information from the records.
- o Knowledge of types and quantities of wastes generated by shops and other areas on base.
- o Based on the above, a determination of the types and quantities of waste disposed of at the site.

S = Suspected confidence level

- o No verbal reports or conflicting verbal reports and no written information from the records.
- o Logic based on a knowledge of the types and quantities of hazardous wastes generated at the base, and a history of past waste disposal practices indicate that these wastes were disposed of at a site.

A-3 Hazard Rating

Hazard Category	Rating Scale Levels 0	1	2	3
Toxicity	Sax's Level 0	Sax's Level 1	Sax's Level 2	Sax's Level 3
Ignitability	Flash point greater than 200°F	Flash point at 140°F to 200°F	Flash point at 80°F to 140°F	Flash point less than 80°F
Radioactivity	At or below background levels	1 to 3 times background levels	3 to 5 times background levels	Over 5 times background levels

Use the highest individual rating based on toxicity, ignitability and radioactivity and determine the hazard rating.

Hazard Rating	Points
High (H)	3
Medium (M)	2
Low (L)	1

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

II. WASTE CHARACTERISTICS (Continued)

Waste Characteristics Matrix

Point Rating	Hazardous Waste Quantity	Confidence Level of Information	Hazard Rating
100	L	C	H
80	L	C	M
	M	C	H
70	L	S	H
60	S	C	H
	M	C	M
50	L	S	M
	L	C	L
	M	S	H
	S	C	M
40	S	S	H
	M	S	M
	M	C	L
	L	S	L
30	S	C	L
	M	S	L
	S	S	M
20	S	S	L

Notes:
For a site with more than one hazardous waste, the waste quantities may be added using the following rules:
Confidence Level
- o Confirmed confidence levels (C) can be added
- o Suspected confidence levels (S) can be added
- o Confirmed confidence levels cannot be added with suspected confidence levels

Waste Hazard Rating
- o Wastes with the same hazard rating can be added
- o Wastes with different hazard ratings can only be added in a downgrade mode, e.g., MCM + SCH = LCM if the total quantity is greater than 20 tons.

Example: Several wastes may be present at a site, each having an MCM designation (60 points). By adding the quantities of each waste, the designation may change to LCM (80 points). In this case, the correct point rating for the waste is 80.

B. Persistence Multiplier for Point Rating

Persistence Criteria	Multiply Point Rating From Part A by the Following
Metals, polycyclic compounds, and halogenated hydrocarbons	1.0
Substituted and other ring compounds	0.9
Straight chain hydrocarbons	0.8
Easily biodegradable compounds	0.4

C. Physical State Multiplier

Physical State	Multiply Point Total From Parts A and B by the Following
Liquid	1.0
Sludge	0.75
Solid	0.50

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

III. PATHWAYS CATEGORY

A. Evidence of Contamination

Direct evidence is obtained from laboratory analyses of hazardous contaminants present above natural background levels in surface water, ground water, or air. Evidence should confirm that the source of contamination is the site being evaluated.

Indirect evidence might be from visual observation (i.e., leachate), vegetation stress, sludge deposits, presence of taste and odors in drinking water, or reported discharges that cannot be directly confirmed as resulting from the site, but the site is greatly suspected of being a source of contamination.

B-1 POTENTIAL FOR SURFACE WATER CONTAMINATION

Rating Factor	Rating Scale Levels 0	1	2	3	Multiplier
Distance to nearest surface water (includes drainage ditches and storm sewers)	Greater than 1 mile	2,001 feet to 1 mile	501 feet to 2,000 feet	0 to 500 feet	8
Net precipitation	Less than -10 in.	-10 to + 5 in.	+5 to +20 in.	Greater than +20 in.	6
Surface erosion	None	Slight	Moderate	Severe	8
Surface permeability	0% to 15% clay ($>10^{-2}$ cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	Greater than 50% clay ($<10^{-6}$ cm/sec)	6
Rainfall intensity based on 1 year 24-hr rainfall	<1.0 inch	1.0-2.0 inches	2.1-3.0 inches	>3.0 inches	8

B-2 POTENTIAL FOR FLOODING

Rating Factor	0	1	2	3	Multiplier
Floodplain	Beyond 100-year floodplain	In 25-year floodplain	In 10-year floodplain	Floods annually	1

B-3 POTENTIAL FOR GROUND-WATER CONTAMINATION

Rating Factor	0	1	2	3	Multiplier
Depth to ground water	Greater than 500 ft	50 to 500 feet	11 to 50 feet	0 to 10 feet	8
Net precipitation	Less than -10 in.	-10 to +5 in.	+5 to +20 in.	Greater than +20 in.	6
Soil permeability	Greater than 50% clay ($>10^{-6}$ cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	0% to 15% clay ($<10^{-2}$ cm/sec)	8
Subsurface flows	Bottom of site greater than 5 feet above high ground-water level	Bottom of site occasionally submerged	Bottom of site frequently submerged	Bottom of site located below mean ground-water level	8
Direct access to ground water (through faults, fractures, faulty well casings, subsidence fissures, etc.)	No evidence of risk	Low risk	Moderate risk	High risk	8

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

IV. WASTE MANAGEMENT PRACTICES CATEGORY

A. This category adjusts the total risk as determined from the receptors, pathways, and waste characteristics categories for waste management practices and engineering controls designed to reduce this risk. The total risk is determined by first averaging the receptors, pathways, and waste characteristics subscores.

B. WASTE MANAGEMENT PRACTICES FACTOR

The following multipliers are then applied to the total risk points (from A):

Waste Management Practice	Multiplier
No containment	1.0
Limited containment	0.95
Fully contained and in full compliance	0.10

Guidelines for fully contained:

<u>Landfills:</u>

- o Clay cap or other impermeable cover
- o Leachate collection system
- o Liners in good condition
- o Adequate monitoring wells

<u>Spills:</u>

- o Quick spill cleanup action taken
- o Contaminated soil removed
- o Soil and/or water samples confirm total cleanup of the spill

<u>Surface Impoundments:</u>

- o Liners in good condition
- o Sound dikes and adequate freeboard
- o Adequate monitoring wells

<u>Fire Proection Training Areas:</u>

- o Concrete surface and berms
- o Oil/water separator for pretreatment of runoff
- o Effluent from oil/water separator to treatment plant

General Note: If data are not available or known to be complete the factor ratings under items I-A through I, III-B-1 or III-B-3, then leave blank for calculation of factor score and maximum possible score.

APPENDIX H

SITE HAZARD ASSESSMENT METHODOLOGY FORMS

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Fire Protection Training Area No. 2
Location:Near southern installation boundary
Date of Operation or Occurrence: 1948 - Present
Owner/Operator: Williams AFB
Comments/Description: Burned fuels, waste oils and other combustible shop wastes

Site Rated by: R. L. Thoem and R. M. Palazzolo

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	1	10	10	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	3	6	18	18
Subtotals			102	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 57

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) 3
2. Confidence level (1=confirmed, 2=suspected) 1
3. Hazard rating (1=low, 2=medium, 3=high) 3

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

100 x 0.80 = 80

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

80 x 1.00 = 80

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	N/A	8	N/A	0
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			38	84
Subscore (100 x factor score subtotal/maximum score subtotal)				45
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			24	114
Subscore (100 x factor score subtotal/maximum score subtotal)				21

C. Highest pathway subscore.
Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 45

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		57	
Waste Characteristics		80	
Pathways		45	
Total	182 divided by 3 =		61 Gross total score

B. Apply factor for waste containment from waste management practices.
Gross total score x waste management practices factor = final score

61 x 1.00 = 61

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Liquid Fuels Storage Area Basin
Location: On "A" St. east of shops and north of vehicle maintenance bldg.
Date of Operation or Occurrence: 1941 - Present
Owner/Operator: Williams AFB
Comments/Description: Several spills and leaks and tank residue disposal area

Site Rated by: R. L. Thoem and R. M.Palazzolo

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	2	4	8	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	1	10	10	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	3	6	18	18
Subtotals			114	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 63

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) 1
2. Confidence level (1=confirmed, 2=suspected) 1
3. Hazard rating (1=low, 2=medium, 3=high) 3

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

100 x 0.80 = 80

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

80 x 1.00 = 80

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			38	108
Subscore (100 x factor score subtotal/maximum score subtotal)				35
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			24	114
Subscore (100 x factor score subtotal/maximum score subtotal)				21

C. Highest pathway subscore.
Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 35

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		63	
Waste Characteristics		80	
Pathways		35	
Total	178	divided by 3 =	59 Gross total score

B. Apply factor for waste containment from waste management practices.
Gross total score x waste management practices factor = final score

59 x 1.00 = 59

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Surface Drainage System - Southwest to Retention Basin
Location:From shops and flightline going southwest to near STP
Date of Operation or Occurrence: 1941 - Present
Owner/Operator: Williams AFB
Comments/Description: Spills from flightline and maintenance, shop waste discharge, and aircraft washing.

Site Rated by: R. L. Thoem and R. M. Palazzolo

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	1	10	10	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	3	6	18	18
Subtotals			124	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 69

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) 1
2. Confidence level (1=confirmed, 2=suspected) 1
3. Hazard rating (1=low, 2=medium, 3=high) 3

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 1.00 = 60

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

60 x 1.00 = 60

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	N/A	8	N/A	0
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			38	84
Subscore (100 x factor score subtotal/maximum score subtotal)				45
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			24	114
Subscore (100 x factor score subtotal/maximum score subtotal)				21

C. Highest pathway subscore.
Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 45

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		69
Waste Characteristics		60
Pathways		45
Total	174	divided by 3 = 58 Gross total score

B. Apply factor for waste containment from waste management practices.
Gross total score x waste management practices factor = final score

58 x 1.00 = 58

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Landfill
Location: Southeast corner of base near sewage treatment plant
Date of Operation or Occurrence: 1941 - 1976
Owner/Operator: Williams AFB
Comments/Description: Paints, thinners and possibly other shop wastes

Site Rated by: R. L. Thoem and R. M. Palazzolo

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	1	10	10	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	3	6	18	18
Subtotals			112	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 62

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) 1
2. Confidence level (1=confirmed, 2=suspected) 1
3. Hazard rating (1=low, 2=medium, 3=high) 3

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 1.00 = 60

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

60 x 1.00 = 60

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			46	108
Subscore (100 x factor score subtotal/maximum score subtotal)				43
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			24	114
Subscore (100 x factor score subtotal/maximum score subtotal)				21

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 43

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		62
Waste Characteristics		60
Pathways		43
Total	165 divided by 3 =	55 Gross total score

B. Apply factor for waste containment from waste management practices.
Gross total score x waste management practices factor = final score

55 x 1.00 = 55

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Pesticide Burial Site
Location: North of landfill and east of sewage treatment plant
Date of Operation or Occurrence: 1968 - 1972
Owner/Operator: Williams AFB
Comments/Description: Buried outdated pesticides on 4 or 5 occasions

Site Rated by: R. L. Thoem and R. M. Palazzolo

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	1	10	10	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	3	6	18	18
Subtotals			112	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 62

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) 1
2. Confidence level (1=confirmed, 2=suspected) 1
3. Hazard rating (1=low, 2=medium, 3=high) 3

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 1.00 = 60

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

60 x 1.00 = 60

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			46	108
Subscore (100 x factor score subtotal/maximum score subtotal)				43
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			24	114
Subscore (100 x factor score subtotal/maximum score subtotal)				21

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 43

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		62
Waste Characteristics		60
Pathways		43
Total	165 divided by 3 =	55 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

55 x 1.00 = 55 FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Surface Drainage System - Northwest
Location: From flightline going northwest and then west
Date of Operation or Occurrence: 1941 - Present
Owner/Operator: Williams AFB
Comments/Description: Spills from flightline, aircraft washing and possible aircraft stripping and shop wastes

Site Rated by: R. L. Thoem and R. M. Palazzolo

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	1	10	10	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	3	6	18	18
Subtotals			124	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 69

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) 1
2. Confidence level (1=confirmed, 2=suspected) 1
3. Hazard rating (1=low, 2=medium, 3=high) 3

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.80 = 48

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

48 x 1.00 = 48

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	N/A	8	N/A	0
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			38	84
Subscore (100 x factor score subtotal/maximum score subtotal)				45
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			24	114
Subscore (100 x factor score subtotal/maximum score subtotal)				21

C. Highest pathway subscore.
Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 45

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	69	
Waste Characteristics	48	
Pathways	45	
Total 162 divided by 3 =		54 Gross total score

B. Apply factor for waste containment from waste management practices.
Gross total score x waste management practices factor = final score

54 x 1.00 = 54

FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Hazardous Materials Storage Area
Location: East of taxiway No. 6 and Building 1080
Date of Operation or Occurrence: 1959 - 1983
Owner/Operator: Williams AFB
Comments/Description: Suspected storage and leakage of hazardous wastes

Site Rated by: R. L. Thoem and R. M. Palazzolo

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	1	10	10	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	3	6	18	18
Subtotals			96	180
Receptors subscore (100 x factor score subtotal/maximum score subtotal)				53

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) 1
2. Confidence level (1=confirmed, 2=suspected) 2
3. Hazard rating (1=low, 2=medium, 3=high) 3

Factor Subscore A (from 20 to 100 based on factor score matrix) 40

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

40 x 0.80 = 32

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

32 x 1.00 = 32

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	0	6	0	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			46	108
Subscore (100 x factor score subtotal/maximum score subtotal)				43
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			24	114
Subscore (100 x factor score subtotal/maximum score subtotal)				21

C. Highest pathway subscore.
Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 43

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		53	
Waste Characteristics		32	
Pathways		43	
Total	128	divided by 3 =	43 Gross total score

B. Apply factor for waste containment from waste management practices.
Gross total score x waste management practices factor = final score

43 x 1.00 = 43 FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Fire Protection Training Area No. 1
Location: Between golf course and runway
Date of Operation or Occurrence: Pre 1948
Owner/Operator: Williams AFB
Comments/Description: Burned contaminated fuels, waste oils and other combustible shop wastes

Site Rated by: R. L. Thoem and R. M. Palazzolo

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	1	10	10	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	3	6	18	18
Subtotals			96	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 53

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) 1
2. Confidence level (1=confirmed, 2=suspected) 2
3. Hazard rating (1=low, 2=medium, 3=high) 3

Factor Subscore A (from 20 to 100 based on factor score matrix) 40

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

40 x 0.80 = 32

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

32 x 1.00 = 32

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	N/A	8	N/A	0
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			30	84
Subscore (100 x factor score subtotal/maximum score subtotal)				36
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			24	114
Subscore (100 x factor score subtotal/maximum score subtotal)				21

C. Highest pathway subscore.
Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 36

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		53
Waste Characteristics		32
Pathways		36
Total	121 divided by 3 =	40 Gross total score

B. Apply factor for waste containment from waste management practices.
Gross total score x waste management practices factor = final score

40 x 1.00 = 40 FINAL SCORE

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Radioactive Material Burial Site
Location: East of landfill and southeast of FPTA No. 2
Date of Operation or Occurrence: Probably before 1960's
Owner/Operator: Williams AFB
Comments/Description: No available data on waste quantity, type, or burial procedure

Site Rated by: R. L. Thoem and R. M. Palazzolo

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	1	10	10	30
F. Water quality of nearest surface water body	0	6	0	18
G. Ground water use of uppermost aquifer	3	9	27	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	3	6	18	18
Subtotals			102	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 57

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) 1
2. Confidence level (1=confirmed, 2=suspected) 1
3. Hazard rating (1=low, 2=medium, 3=high) 3

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 1.00 = 60

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

60 x 0.50 = 30

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	0	6	0	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	1	8	8	24
Subtotals			38	108
Subscore (100 x factor score subtotal/maximum score subtotal)				35
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	1	8	8	24
Net precipitation	0	6	0	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			24	114
Subscore (100 x factor score subtotal/maximum score subtotal)				21

C. Highest pathway subscore.
Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 35

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		57
Waste Characteristics		30
Pathways		35
Total	122 divided by 3 =	41 Gross total score

B. Apply factor for waste containment from waste management practices.
Gross total score x waste management practices factor = final score

41 x 0.95 = 39 FINAL SCORE

APPENDIX I
GLOSSARY OF TERMINOLOGY AND ABBREVIATIONS

APPENDIX I

GLOSSARY OF TERMINOLOGY AND ABBREVIATIONS

ABG: Air Base Group

ACFT MAINT: Aircraft Maintenance.

AF: Air Force.

AFB: Air Force Base.

AFESC: Air Force Engineering and Services Center.

AFFF: Aqueous Film Forming Foam, a fire extinquishing agent.

AFR: Air Force Regulation.

Ag: Chemical symbol for silver.

AGE: Aerospace Ground Equipment.

Al: Chemical symbol for aluminum.

ALLUVIUM: Materials eroded, transported and deposited by streams.

ALLUVIAL FAN: A fan-shaped deposit formed by a stream either where it issues from a narrow mountain valley into a plain or broad valley, or where a tributary stream joins a main stream.

ANTICLINE: A fold in which layered strata are inclined down and away from the axes.

ARTESIAN: Ground water contained under hydrostatic pressure.

AQUICLUDE: Poorly permeable formation that impedes ground-water movement and does not yield to a well or spring.

AQUIFER: A geologic formation, group of formations, or part of a formation that is capable of yielding water to a well or spring.

AQUITARD: A geologic unit which impedes ground-water flow.

AROMATIC: Description of organic chemical compounds in which the carbon atoms are arranged into a ring with special electron stability associated. Aromatic compounds are often more reactive than non-aromatics.

ATC: Air Training Command.

AVGAS: Aviation Gasoline.

Ba: Chemical symbol for barium.

BES: Bioenvironmental Engineering Services.

BIOACCUMULATE: Tendency of elements or compounds to accumulate or build up in the tissues of living organisms when they are exposed to these elements in their environments, e.g., heavy metals.

BIODEGRADABLE: The characteristic of a substance to be broken down from complex to simple compounds by microorganisms.

BOWSER: A portable tank, usually under 200 gallons in capacity.

BX: Base Exchange.

$CaCO_3$: Chemical symbol for calcium carbonate.

CAMS: Consolidated Aircraft Maintenance Squadron.

Cd: Chemical symbol for cadmium.

CE: Civil Engineering.

CERCLA: Comprehensive Environmental Response, Compensation and Liability Act.

CES: Civil Engineering Squadron.

CIRCA: About; used to indicate an approximate date.

CLOSURE: The completion of a set of rigidly defined functions for a hazardous waste facility no longer in operation.

CMS: Component Maintenance Squadron.

CN: Chemical symbol for cyanide.

COD: Chemical Oxygen Demand, a measure of the amount of oxygen required to oxidize organic and oxidizable inorganic compounds in water.

COE: Corps of Engineers.

CONFINED AQUIFER: An aquifer bounded above and below by impermeable strata or by geologic units of distinctly lower permeability than that of the aquifer itself.

CONFINING UNIT: An aquitard or other poorly permeable layer which restricts the movement of ground water.

CONTAMINATION: The degradation of natural water quality to the extent that its usefulness is impaired; there is no implication of any specific limits since the degree of permissible contamination depends upon the intended end use or uses of the water.

Cr: Chemical symbol for chromium.

Cu: Chemical symbol for copper.

DET: Detachment.

2,4-D: Abbreviation for 2,4-dichlorophenoxyacetic acid, a common weed killer and defoliant.

DIP: The angle at which a stratum is inclined from the horizontal.

DISPOSAL FACILITY: A facility or part of a facility at which hazardous waste is intentionally placed into or on land or water, and at which waste will remain after closure.

DISPOSAL OF HAZARDOUS WASTE: The discharge, deposit, injection, dumping, spilling, or placing of any hazardous waste into or on land or water so that such waste or any constituent thereof may enter the environment or be emitted into the air or discharged into any waters, including ground water.

DOD: Department of Defense.

DOWNGRADIENT: In the direction of decreasing hydraulic static head; the direction in which ground water flows.

DPDO: Defense Property Disposal Office, previously included Redistribution and Marketing (R&M) and Salvage.

DUMP: An uncovered land disposal site where solid and/or liquid wastes are deposited with little or no regard for pollution control or aesthetics; dumps are susceptible to open burning and are exposed to the elements, disease vectors and scavengers.

EFFLUENT: A liquid waste discharge from a manufacturing or treatment process, in its natural state, or partially or completely treated, that discharges into the environment.

EP: Extraction Procedure, the EPA's standard laboratory procedure for leachate generation.

EPA: U.S. Environmental Protection Agency.

EPHEMERAL AQUIFER: A water-bearing zone typically located near the surface which normally contains water seasonally.

EROSION: The wearing away of land surface by wind, water, or chemical processes.

ES: Engineering-Science, Inc.

FAA: Federal Aviation Administration.

FACILITY: Any land and appurtenances thereon and thereto used for the treatment, storage and/or disposal of hazardous wastes.

FAULT: A fracture in rock along which the adjacent rock surfaces are differentially displaced.

Fe: Chemical symbol for iron.

FLOOD PLAIN: The lowland and relatively flat areas adjoining inland and coastal areas of the mainland and off-shore islands, including, at a minimum, areas subject to a one percent or greater chance of flooding in any given year.

FLOW PATH: The direction or movement of ground water as governed principally by the hydraulic gradient.

FMS: Field Maintenance Squadron.

FPTA: Fire Protection Training Area.

FTW: Flying Training Wing.

GC/MS: Gas chromatograph/mass spectrophotometer, a laboratory procedure for identifying unknown organic compounds.

GLACIAL TILL: Unsorted and unstratified drift consisting of clay, sand, gravel and boulders which is deposited by or underneath a glacier.

GROUND WATER: Water beneath the land surface in the saturated zone that is under atmospheric or artesian pressure.

GROUND WATER RESERVOIR: The earth materials and the intervening open spaces that contain ground water.

HALOGEN: The class of chemical elements including fluorine, chlorine, bromine, and iodine.

HARDFILL: Disposal sites receiving construction debris, wood, miscellaneous spoil material.

HARM: Hazard Assessment Rating Methodology.

*HAZARDOUS SUBSTANCE: Under CERCLA, the definition of hazardous substance includes:

1. All substances regulated under Paragraphs 311 and 307 of the Clean Water Act (except oil);

2. All substances regulated under Paragraph 3001 of the Solid Waste Disposal Act;

3. All substances regulated under Paragraph 112 of the Clean Air Act;

4. All substances which the Administrator of EPA has acted against under Paragraph 7 of the Toxic Substance Control Act;

5. Additional substances designated under Paragraph 102 of the Superfund bill.

*HAZARDOUS WASTE: As defined in RCRA, a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical or infectious characteristics may cause or significantly contribute to an increase in mortality or an increase in serious, irreversible, or incapacitating reversible illness; or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.

HAZARDOUS WASTE GENERATION: The act or process of producing a hazardous waste.

HEAVY METALS: Metallic elements, including the transition series, which include many elements required for plant and animal nutrition in trace concentrations but which become toxic at higher concentrations.

Hg: Chemical symbol for mercury.

HQ: Headquarters.

HWMF: Hazardous Waste Management Facility.

HYDROCARBONS: Organic chemical compounds composed of hydrogen and carbon atoms chemically bonded. Hydrocarbons may be straight chain, cyclic, branched chain, aromatic, or polycyclic, depending upon arrangement of carbon atoms. Halogenated hydrocarbons are hydrocarbons in which one or more hydrogen atoms has been replaced by a halogen atom.

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*For purposes of this Phase I IRP report hazardous substances and hazardous wastes are considered synonymous.

INCOMPATIBLE WASTE: A waste unsuitable for commingling with another waste or material because the commingling might result in generation of extreme heat or pressure, explosion or violent reaction, fire, formation of substances which are shock sensitive, friction sensitive, or otherwise have the potential for reacting violently, formation of toxic dusts, mists, fumes, and gases, volatilization of ignitable or toxic chemicals due to heat generation in such a manner that the likelihood of contamination of ground water or escape of the substance into the environment is increased, any other reaction which might result in not meeting the air, human health, and environmental standards.

INFILTRATION: The movement of water through the soil surface into the ground.

IRP: Installation Restoration Program.

ISOPACH: Graphic presentation of geologic data, including lines of equal unit thickness that may be based on confirmed (drill hole) data or indirect geophysical measurement.

JP-4: Jet Propulsion Fuel Number Four, military jet fuel.

LEACHATE: A solution resulting from the separation or dissolving of soluble or particulate constituents from solid waste or other man-placed medium by percolation of water.

LEACHING: The process by which soluble materials in the soil, such as nutrients, pesticide chemicals or contaminants, are washed into a lower layer of soil or are dissolved and carried away by water.

LENTICULAR: A bed or rock stratum or body that is lens-shaped.

LINER: A continous layer of natural or man-made materials beneath or on the sides of a surface impoundment, landfill, or landfill cell which restricts the downward or lateral escape of hazardous waste, hazardous waste constituents or leachate.

LITHOLOGY: The description of the physical character of a rock.

LOESS: An essentially unconsolidated unstratified calcareous silt; commonly homogeneous, permeable and buff to gray in color.

LOX: Liquid oxygen.

LUKE AFB: Luke Air Force Base.

LYSIMETER: A vacuum operated sampling device used for extracting pore water samples at various depths within the unsaturated zone.

MAC: Military Airlift Command.

MEK: Methyl Ethyl Ketone.

METALS: See "Heavy Metals".

MGD: Million gallons per day.

MOA: Military Operating Area.

MIBK: Methyl isobutyl ketone.

MOGAS: Motor gasoline.

Mn: Chemical symbol for manganese.

MODIFIED MERCALLI INTENSITY: A number describing the effects of an earthquake on man, structures and the earth's surface. A Modified Mercalli Intensity of I is not felt. An intensity of VI is felt indoors and outdoors and for an intensity of VII it becomes difficult for a man to remain standing. Intensities of IX to XII involve increasing levels of destruction with destruction being nearly total at an intensity of XII.

MONITORING WELL: A well used to measure ground-water levels and to obtain samples.

MORAINE: An accumulation of glacial drift deposited chiefly by direct glacial action and possessing initial constructional form independent of the floor beneath it.

MSL: Mean Sea Level.

MWR: Morale, Welfare and Recreation.

NCO: Non-commissioned Officer.

NCOIC: Non-commissioned Officer In-Charge.

NDI: Non-destructive inspection.

NET PRECIPITATION: The amount of annual precipitation minus annual evaporation.

NGVD: National Geodetic Vertical Datum of 1929.

Ni: Chemical symbol for nickel.

NOAA: National Oceanic and Atmospheric Administration.

NPDES: National Pollutant Discharge Elimination System.

OEHL: Occupational and Environmental Health Laboratory.

OIC: Officer-In-Charge.

OMS: Organizational Maintenance Squadron.

ORGANIC: Being, containing or relating to carbon compounds, especially in which hydrogen is attached to carbon.

OSI: Office of Special Investigations.

O&G: Symbols for oil and grease.

Pb: Chemical symbol for lead.

PCB: Polychlorinated Biphenyl; liquids used as a dielectrics in electrical equipment.

PC-111: Chemical cleaning solution.

PD-680: Cleaning solvent.

PERCHED WATER TABLE: A water table above a relatively impermeable zone underlain by unsaturated rocks of sufficient permeability to allow ground-water movement.

PERCOLATION: Movement of moisture by gravity or hydrostatic pressure through interstices of unsaturated rock or soil.

PERMEABILITY: The capacity of a porous rock, soil or sediment for transmitting a fluid without damage to the structure of the medium.

PERSISTENCE: As applied to chemicals, those which are very stable and remain in the environment in their original form for an extended period of time.

PESTICIDE: An agent used to destroy pests. Pesticides include such specialty groups as herbicides, fungicides, insecticides, etc.

pH: Negative logarithm of hydrogen ion concentration.

PL: Public Law.

POL: Petroleum, Oils and Lubricants.

POLLUTANT: Any introduced gas, liquid or solid that makes a resource unfit for a specific purpose.

POLYCYCLIC COMPOUND: All compounds in which carbon atoms are arranged into two or more rings, usually aromatic in nature.

POTENTIALLY ACTIVE FAULT: A fault along which movement has occurred within the last 25-million years.

POTENTIOMETRIC SURFACE: The imaginery surface to which water in an artesian aquifer would rise in tightly screened wells penetrating it.

PPB: Parts per billion by weight.

PPM: Parts per million by weight.

PRECIPITATION: Rainfall.

QUATERNARY MATERIALS: The second period of the Cenozoic geologic era, following the Tertiary, and including the last 2-3 million years.

RCRA: Resource Conservation and Recovery Act.

RECEPTORS: The potential impact group or resource for a waste contamination source.

RECHARGE AREA: A surface area in which surface water or precipitation percolates through the unsaturated zone and eventually reaches the zone of saturation. Recharge areas may be natural or manmade.

RECHARGE: The addition of water to the ground-water system by natural or artificial processes.

RECON: Reconnaissance.

RIPARIAN: Living or located on a riverbank.
RM: Resource Management.

SANITARY LANDFILL: A land disposal site using an engineered method of disposing solid wastes on land in a way that minimizes environmental hazards.

SATURATED ZONE: That part of the earth's crust in which all voids are filled with water.

SAX'S TOXICITY: A rating method for evaluating the toxicity of chemical materials.

SCS: U.S. Department of Agriculture Soil Conservation Service.

SEISMICITY: Pertaining to earthquakes or earth vibrations.

SLUDGE: The solid residue resulting from a manufacturing or wastewater treatment process which also produces a liquid stream.

SOLID WASTE: Any garbage, refuse, or sludge from a waste treatment plant, water supply treatment, or air pollution control facility and other discarded material, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining, or agricultural operations and from community activities, but does not include solid or dissolved materials in domestic sewage; solid or dissolved materials in irrigation return flows; industrial discharges which are point source subject to permits under Section 402 of the Federal Water Pollution Control Act, as amended (86 USC 880); or source, special nuclear, or by-product material as defined by the Atomic Energy Act of 1954 (68 USC 923).

SP: Spill area.

SPILL: Any unplanned release or discharge of a hazardous waste onto or into the air, land, or water.

STORAGE OF HAZARDOUS WASTE: Containment, either on a temporary basis or for a longer period, in such a manner as not to constitute disposal of such hazardous waste.

STP: Sewage Treatment Plant.

TAC: Tactical Air Command

TCE: Trichloroethylene.

2,4,5-T: Abbreviation for 2,4,5-trichlorophenoxyacetic acid, a common herbicide.

TDS: Total Dissolved Solids, a water quality parameter.

TFTS: Tactical Fighter Training Squadron.

TOC: Total Organic Carbon.

TOXICITY: The ability of a material to produce injury or disease upon exposure, ingestion, inhalation, or assimilation by a living organism.

TRANSMISSIVITY: The rate at which water is transmitted through a unit width of aquifer under a unit hydraulic gradient.

TREATMENT OF HAZARDOUS WASTE: Any method, technique, or process including neutralization designed to change the physical, chemical, or biological character or composition of any hazardous waste so as to neutralize the waste or so as to render the waste nonhazardous.

TSD: Treatment, storage or disposal.

UPGRADIENT: In the direction of increasing hydraulic static head; the direction opposite to the prevailing flow of groundwater.

USAF: United States Air Force.

USAFSS: United States Air Force Security Service.

USDA: United States Department of Agriculture.

USFWS: United States Fish and Wildlife Service.

USGS: United States Geological Survey.

USMC: United States Marine Corps.

USN: United States Navy.

WAFB: Williams Air Force Base

WATER TABLE: Surface of a body of unconfined ground water at which the pressure is equal to that of the atmosphere.

WWTP: Wastewater Treatment Plant.

Zn: Chemical symbol for zinc.

APPENDIX J

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REFERENCES

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APPENDIX K

INDEX OF REFERENCES TO POTENTIAL CONTAMINATION SITES AT WILLIAMS AFB

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Site	References (Page Numbers)
Fire Protection Training Area No. 1	5, 6, 4-22, 4-36, 4-38, 5-2, 5-4, 6-9
Fire Protection Training Area No. 2	3, 5, 7, 4-22, 4-36, 4-38, 5-1, 5-2, 6-1, 6-2, 6-9
Landfill	3, 5, 8, 4-24, 4-27, 4-36, 4-38, 5-2, 5-3, 6-3, 6-5, 6-9
Surface Drainage System - Southwest	3, 5, 7, 4-32, 4-36, 4-38, 5-2, 5-3, 6-2, 6-5, 6-9
Surface Drainage System - Northwest	3, 5, 8, 4-32, 4-36, 4-38, 5-1, 5-4, 6-3, 6-7, 6-9
Hazardous Materials Storage Area	5, 6, 4-12, 4-36, 4-38, 5-2, 5-4, 6-9
Pesticide Burial Site	3, 5, 8, 4-26, 4-27, 4-36, 4-38, 5-2, 5-3, 6-3, 6-7, 6-9
Radioactive Material Burial Site	5, 6, 4-26, 4-27, 4-36, 4-38, 5-2, 5-4, 6-7
Liquid Fuels Storage Area	3, 5, 7, 4-19, 4-36, 4-38, 5-1, 5-2, 6-2, 6-5, 6-9